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JULY 23, 1973

VOLUME 11 • NUMBER 14

N73-22943— N73-23993

NATIONAL AERONAUTICS AND SPACE ADMINISTRATION

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Scientific and Technical Aerospace Reports, Volume 11, is prepared by the NASA Scientific and Technical Information Facility operated for the National Aeronautics and Space Administration by Informatics Tisco, Inc.

The Administrator of the National Aeronautics and Space Administration has determined that the publication of this periodical is necessary in the transaction of the public business required by law of this Agency. Use of funds for printing this periodical has been approved by the Director of the Office of Management and Budget through April 1, 1974.

INTRODUCTION

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The authority for the indexing vocabulary used in the subject index of this issue of *STAR* is the *NASA Thesaurus*. The most recent version is the *NASA Thesaurus—Alphabetical Update* (NASA SP-7040), September 1971, which is available from NTIS as accession number N72-15923 for $6.00 in paper copy. The current cross-reference structuring for each term appears in this volume, together with additional approved terms that may be used in indexing documents announced in other issues of *STAR*. NASA SP-7040 supersedes the first two volumes (subject terms A–Z) of the three-volume *Preliminary Edition of the NASA Thesaurus* (NASA SP-7030), December 1967. Volume III of the Preliminary Edition presented the following aids to vocabulary selection of the 1967 terms: hierarchical display of index terms, category terms listing, and permuted index; this has not been updated but may still be useful.

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02 Aircraft 1599
Includes fixed-wing airplanes, helicopters, gliders, balloons, ornithopters, etc.; and specific types of complete aircraft (e.g., ground effect machines, STOL, and VTOL); flight tests; operating problems (e.g., sonic boom); safety and safety devices; economics; and stability and control. For basic research see: 01 Aerodynamics. For related information see also: 31 Space Vehicles; and 32 Structural Mechanics.

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Includes aerospace medicine, exobiology, radiation effects on biological systems; physiological and psychological factors. For related information see also: 05 Biotechnology.

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Includes life support systems, human engineering; protective clothing and equipment; crew training and evaluation, and piloting. For related information see also: 04 Biosciences.

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10 Electronics 1643
Includes circuit theory; and feedback and control theory. For applications see: 09 Electronic Equipment. For related information see specific Physics categories.

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12 Fluid Mechanics 1647
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13 Geophysics 1653
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14 Instrumentation and Photography 1666
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15 Machine Elements and Processes 1670
Includes bearings, seals, pumps, and other mechanical equipment; lubrication, friction, and wear; manufacturing processes and quality control; reliability; drafting; and materials fabrication, handling, and inspection.

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Includes cermets; corrosion; physical and mechanical properties of materials; metallurgy; and applications as structural materials. For basic research see: 06 Chemistry. For related information see also: 18 Materials, Nonmetallic; and 32 Structural Mechanics.

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Includes climatology; weather forecasting; and visibility studies. For related information see also: 13 Geophysics; and 30 Space Sciences.

21 Navigation 1687
Includes guidance; autopilots; star and planet tracking; inertial platforms; and air traffic control. For related information see also: 07 Communications.

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30 Space Sciences 1703
Includes astronomy and astrophysics; cosmology; lunar and planetary flight and exploration; and theoretical analysis of orbits and trajectories. For related information see also: 11 Facilities, Research and Support; and 31 Space Vehicles.

31 Space Vehicles 1707
Includes launch vehicles; manned space capsules; clustered and multistage rockets; satellites; sounding rockets and probes; and operating problems. For basic research see: 30 Space Sciences. For related information see also: 28 Propulsion Systems; and 32 Structural Mechanics.

32 Structural Mechanics 1714
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33 Thermodynamics and Combustion 1718
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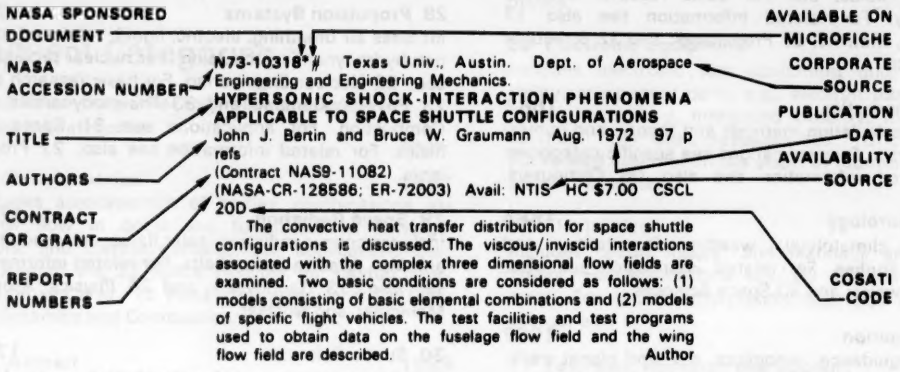
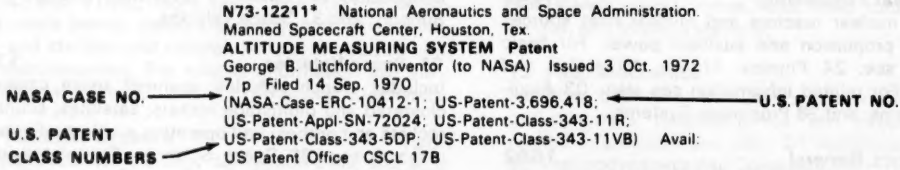


N73-10318*# Texas Univ., Austin. Dept. of Aerospace Engineering and Engineering Mechanics.
HYPERSONIC SHOCK-INTERACTION PHENOMENA APPLICABLE TO SPACE SHUTTLE CONFIGURATIONS
John J. Bertin and Bruce W. Graumann Aug. 1972 97 p refs
(Contract NAS9-11082)
(NASA-CR-128586; ER-72003) Avail: NTIS HC $7.00 CSCL 20D

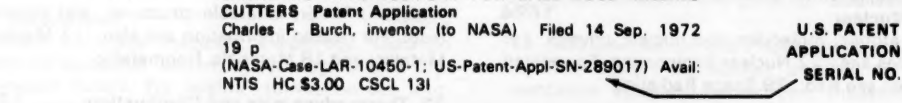
The convective heat transfer distribution for space shuttle configurations is discussed. The viscous/inviscid interactions associated with the complex three dimensional flow fields are examined. Two basic conditions are considered as follows: (1) models consisting of basic elemental combinations and (2) models of specific flight vehicles. The test facilities and test programs used to obtain data on the fuselage flow field and the wing flow field are described. Author

PATENT CITATION



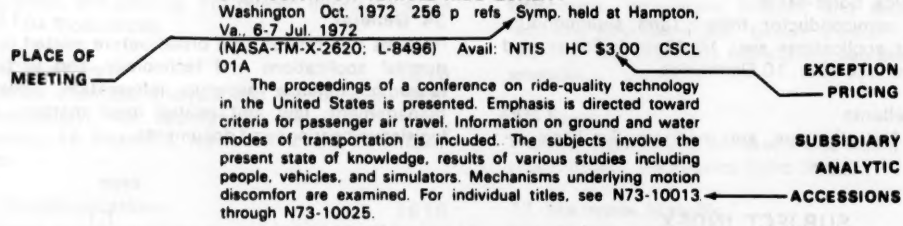
N73-12211* National Aeronautics and Space Administration. Manned Spacecraft Center, Houston, Tex.
ALTITUDE MEASURING SYSTEM Patent
George B. Litchford, inventor (to NASA) Issued 3 Oct. 1972 7 p Filed 14 Sep. 1970
(NASA-Case-ERC-10412-1; US-Patent-3,696,418; US-Patent-Appl-SN-72024; US-Patent-Class-343-11R; US-Patent-Class-343-5DP; US-Patent-Class-343-11VB) Avail: US Patent Office CSCL 17B

PATENT APPLICATION CITATION



N73-10504*# National Aeronautics and Space Administration. Langley Research Center, Langley Station, Va.
GRINDING ARRARNGEMENT FOR BALL NOSE MILLING CUTTERS Patent Application
Charles F. Burch, inventor (to NASA) Filed 14 Sep. 1972 19 p
(NASA-Case-LAR-10450-1; US-Patent-Appl-SN-289017) Avail: NTIS HC $3.00 CSCL 13I

PRIMARY ANALYTIC CITATION AND ABSTRACT



N73-10012*# National Aeronautics and Space Administration. Langley Research Center, Langley Station, Va.
SYMPOSIUM ON VEHICLE RIDE QUALITY
Washington Oct. 1972 256 p refs Symp. held at Hampton, Va., 6-7 Jul. 1972
(NASA-TM-X-2620; L-8498) Avail: NTIS HC $3.00 CSCL 01A

The proceedings of a conference on ride-quality technology in the United States is presented. Emphasis is directed toward criteria for passenger air travel. Information on ground and water modes of transportation is included. The subjects involve the present state of knowledge, results of various studies including people, vehicles, and simulators. Mechanisms underlying motion discomfort are examined. For individual titles, see N73-10013 through N73-10025.

SUBSIDIARY ANALYTIC CITATION

N73-10014* Douglas Aircraft Co., Inc., Long Beach, Calif.
AN AIRCRAFT MANUFACTURER'S APPROACH TO RIDEABILITY CRITERIA
R. C. OMassey, H. Leve, and J. G. Gaume *In* NASA. Langley Res. Center Symp. on Vehicle Ride Quality Oct. 1972 p 23-49 refs (For availability see N73-10012 01-02)
CSCL 01A

VOLUME 11 NUMBER 14 / JULY 23, 1973

Scientific and Technical Aerospace Reports

A Semimonthly Publication of the National Aeronautics and Space Administration

01 AERODYNAMICS

Includes aerodynamics of bodies, combinations, internal flow in ducts and turbomachinery; wings, rotors, and control surfaces. For applications see: 02 Aircraft and 31 Space Vehicles. For related information see also: 12 Fluid Mechanics; and 33 Thermodynamics and Combustion.

N73-22943# Technological Lab. RVO-TNO, Rijswijk (Netherlands).

VELOCITY DECREASES OF FRAGMENTS: LITERATURE REVIEW [SNELHEIDSAFNAME VAN SCHERVEN: LITERATUUR OVERZICHT]

G. G. Thomas 26 Oct. 1972 19 p refs In DUTCH (A72/KL/024)

(TL-1972-16) Avail: NTIS HC $3.00

Slowdown differences for spherical and cube-shaped bodies, and for cube-shaped and non-cubic fragments are calculated as functions of velocity and distance. The results of these calculations are shown graphically. Transl. by G.G.

N73-22944# Rennes Univ. (France). Dept. de Mathematiques et Informatique.

PROGRAM FOR CALCULATING WING PROFILES AT MACH 1 [PROGRAMME DE CALCUL DE PROFILS D'AILES A MACH 1]

D. Euvrard and G. Tournemine Paris Soc. Natl. Ind. Aerospatials 9 Nov. 1972 31 p refs In FRENCH Presented at 9th Conf. on Appl. Aerodyn., Paris, 8 and 10 Nov. 1972 and Saint-Cyr-l'Ecole, France, 9 Nov. 1972

Avail: NTIS HC $3.75

A numerical method is proposed for treating the classical problem of nonlinear elliptic-hyperbolic mixing. The Lax finite difference scheme and asymptotic procedures are used for the study, and the firing problem is also solved. The method also permits the calculation of sonic flow about a wing profile. Transl. by E.H.W.

N73-22945# Tokyo Univ. (Japan). Inst. of Space and Aeronautical Science.

ROLL COUPLING MOMENT OF DEFLECTED WING BODY COMBINATION

Shigeki Tsukamoto Dec. 1972 41 p refs

(ISAS-488(Vol-37/No-14)) Avail: NTIS HC $4.25

A method of analysis based on the slender-body theory has been developed to investigate the characteristics of the roll coupling moment due to the flow induced by deflected wings and cross flow. The method makes use of conformal mapping of the well-known hydrodynamics and numerical integration. Flow patterns on the wing have been obtained in the form of elliptic integrals and are shown for various values of span to body radius ratio. Calculations have been performed for uniformly canted and elastically deflected wings in planar and cruciform wing-body combinations. It is shown that there exists a considerably wide region (from the root to 50-57 percent of the wing span) where unduced velocity has negative sign for the elastically deffected wings. Roll coupling moment coefficients are also presented for various wing-body combinations. Author

N73-22946# Institut Aerotechnique de Saint-Cyr, Saint-Cyr-l'Ecole (France).

SIGMA 4 AFTERBODY [LES ARRIERES-CORPS A SIGMA 4]

Y. Sagnard Paris Soc. Natl. Ind. Aerospatiale 1972 25 p refs In FRENCH Presented at 9th Conf. on Appl. Aerodyn., Paris, 8 and 10 Nov. 1972 and Saint-Cyr-l'Ecole, France, 9 Nov. 1972

Avail: NTIS HC $3.25

A description is given of the wind tunnel installation used to simulate and test sigma 4 afterbody performance in the Mirage 3 aircraft. Injector nozzle internal reactions, skin friction, flow instability, and primary and secondary flow are measured. Afterbody performance, precision, and fidelity are discussed. Transl. by E.H.W.

N73-22947*# National Aeronautics and Space Administration. Lewis Research Center, Cleveland, Ohio.

THROAT-BYPASS BLEED SYSTEMS FOR INCREASING THE STABLE AIRFLOW RANGE OF A MACH 2.50 AXISYMMETRIC INLET WITH 40-PERCENT INTERNAL CONTRACTION

Bobby W. Sanders and Glenn A. Mitchell Washington May 1973 88 p refs

(NASA-TM-X-2779; E-7240) Avail: NTIS HC $3.00 CSCL 20D

The results of an experimental investigation to increase the stable airflow range of a supersonic mixed-compression inlet are presented. Various throat-bypass bleeds were located on the inlet cowl. The bleed types were distributed porous normal holes, a forward slanted slot, or distributed educated slots. Large inlet stability margins were obtained with the inlet throat bleed systems if a constant pressure was maintained in the throat-bypass bleed plenum. Stability limits were determined for steady-state and limited transient internal air flow changes. Limited unstart angle-of-attack data are presented. Author

N73-22948# Advisory Group for Aerospace Research and Development, Paris (France). Fluid Dynamics Panel.

HELICOPTER AERODYNAMICS AND DYNAMICS

Mar. 1973 378 p refs Lectures presented at Rhode-St.-Genese, Belgium, 2-6 Apr. 1973; sponsored in part by von Karman Inst.

(AGARD-LS-63) Avail: NTIS HC $21.00

The role of aerodynamics and dynamics in helicopter development from the fundamental methods and principles through conceptual design to flight test and proof-of-concept is discussed. The subjects presented include the following: (1) applications of aerodynamics and dynamics to rotary wing aircraft; (2) basic aerodynamics and performance of the helicopter; (3) basic dynamics of rotary wings; (4) aeroelasticity of rotary wing aircraft; (5) helicopter noise analysis; (6) rotary wing model testing in wind tunnels; (6) selection of configuration and prototype design; and (7) flight testing for performance and flying qualities. For individual titles, see N73-22949 through N73-22959.

N73-22949 Army Air Mobility Research and Development Lab., Moffett Field, Calif.

THE ROLE OF AERODYNAMICS AND DYNAMICS IN MILITARY AND CIVILIAN APPLICATIONS OF ROTARY WING AIRCRAFT

Paul F. Yaggy *In* AGARD Helicopter Aerodyn. and Dyn. Mar. 1973 14 p (For availability see N73-22948 14-01)

The various aerodynamic and dynamic factors which influence the design of helicopters are discussed. The subjects presented are: (1) performance requirements; (2) dynamics, stability, and control; (3) airloads, aeroelasticity, and mechanical instabilities; and (4) proof of technology. Performance charts for typical helicopter configurations are included. Author

N73-22950 Boeing Co., Philadelphia, Pa. Vertol Div.

BASIC AERODYNAMICS AND PERFORMANCE OF THE HELICOPTER c02

W. Z. Stepniewski *In* AGARD Helicopter Aerodyn. and Dyn. Mar. 1973 62 p refs (For availability see N73-22948 14-01)

The fundamentals of rotary wing aerodynamics and their application to performance considerations of helicopters are discussed. The subjects presented are: (1) momentum theory; (2) blade element theory; (3) fundamentals of vortex theory; (4) applications of theory to design of rotary wing aircraft and performance optimization; and (5) example of helicopter performance prediction based on current industrial practice. Author

N73-22951 Messerschmitt-Boelkow-Blohm G.m.b.H., Ottobrunn (West Germany).

BASIC DYNAMICS OF ROTORS; CONTROL AND STABILITY OF ROTARY WING AIRCRAFT; AERODYNAMICS AND DYNAMICS OF ADVANCED ROTARY-WING CONFIGURATIONS

G. Reichert *In* AGARD Helicopter Aerodyn. and Dyn. Mar. 1973 50 p refs (For availability see N73-22948 14-01)

Rotary wing configurations such as teetering, articulated, elastomeric-bearing, rotor hub, and hingeless systems are discussed. The basic dynamics of rotary wings are presented to show the elementary forces on a blade element, motion of rotary wing blades, and the influence of inplane stiffness, elastic coupling effects. The mechanics of helicopter flight are analyzed to demonstrate the principles of helicopter control, static and dynamic stability, and maneuver capability. The aerodynamics and dynamics of advanced rotary wing configurations are examined. Author

N73-22952 Office National d'Etudes et de Recherches Aerospatiales, Paris (France).

AEROELASTICITY OF ROTARY WING AIRCRAFT

Rolland Dat *In* AGARD Helicopter Aerodyn. and Dyn. Mar. 1973 33 p refs (For availability see N73-22948 14-01)

The effects of aeroelasticity on the performance of rotary wing aircraft are discussed. Flutter instability is illustrated by the case of an airfoil and the theoretical tools used to investigate the flutter of a flexible wing are presented. Procedures for predicting the aerodynamic forces on the blades of rotary wings are developed. A formulation of the problem of forced vibration in forward flight is given. Mathematical models are included to support the theoretical considerations. Author

N73-22953 Loughborough Univ. of Technology (England).

HELICOPTER NOISE: ANALYSIS - PREDICTION AND METHODS OF REDUCTION c02

Martin V. Lowson *In* AGARD Helicopter Aerodyn. and Dyn. Mar. 1973 37 p refs (For availability see N73-22948 14-01)

The fundamentals of helicopter noise radiatipn phenomena are presented, to include a review of the features of subjective response. Emphasis is placed on the basic mechanisms of rotor noise generation, both for discrete frequency and broad band noise components. The implications for helicopter noise control are discussed. A review of possible propagation effects and the potential costs of helicopter noise reduction are included. Author

N73-22954 Societe Nationale Industrielle Aerospatiale, Marseille (France). Div. Helicopteres.

DRAG PROBLEMS ON ROTARY WING AIRCRAFT

Paul Fabre *In* AGARD Helicopter Aerodyn. and Dyn. Mar. 1973 12 p ref In ENGLISH and FRENCH (For availability see N73-22948 14-01)

The effects of aerodynamic drag on rotary wing performance are analyzed. The influence of stall and compressibility on rotor drag is examined. An example of parasite drag reduction by fairing the rotor head is presented. The nature of helicopter in-flight limitations and methods for improving performance through autogyro configuration and reduction of rotor rotational speed are submitted. Author

N73-22955 Boeing Co., Philadelphia, Pa. Vertol Div.

AERODYNAMIC AND DYNAMIC ROTARY WING MODEL TESTING IN WIND TUNNELS AND OTHER FACILITIES c11

Franklin D. Harris *In* AGARD Helicopter Aerodyn. and Dyn. Mar. 1973 62 p refs (For availability see N73-22948 14-01)

Procedures for testing models of rotary wing aircraft in wind tunnels are discussed. The test objectives involved in rotary wing tunnel tests are described. The characteristics of various testing facilities are analyzed and compared. Methods for obtaining and reducing wind tunnel data are presented. Cost considerations for models and test facilities are analyzed to provide basis for decision on construction and modification. Examples of typical wind tunnel tests conducted with rotary wing models are included. Author

N73-22956 Boeing Co., Philadelphia, Pa. Vertol Div.

FACTORS IN THE DESIGN AND FABRICATION OF POWERED DYNAMICALLY SIMILAR V/STOL WIND TUNNEL MODELS (APPENDIX 1) c11

Carl O. Albrecht *In* AGARD Helicopter Aerodyn. and Dyn. Mar. 1973 24 p refs (For availability see N73-22948 14-01)

The factors involved in the design of a wind tunnel for testing V/STOL aircraft models are discussed. Mach-scaled rotor systems are analyzed to show development and construction. A review of Mach-scaling and Froude-scaling is included to show the relative advantages of each method. Techniques for constructing the models are illustrated. The construction of the test stands and specialized test equipment is explained. Author

N73-22957 Boeing Co., Philadelphia, Pa. Vertol Div.

THE EFFECTS OF REYNOLDS NUMBER ON ROTOR STALL (APPENDIX 2)

William G. S. Hardy *In* AGARD Helicopter Aerodyn. and Dyn. Mar. 1973 8 p refs (For availability see N73-22948 14-01)

A theoretical analysis of the effects of Reynolds number on the aerodynamic stalling of rotary wings is presented. A comparison of full scale Reynolds number and model scale Reynolds number for specific airfoil configurations is made. The effects of aeroelasticity on rotary wing performance are analyzed. The relationship of Reynolds number to the aerodynamic coefficients of rotary wings is established. Author

N73-22958 Messerschmitt-Boelkow-Blohm G.m.b.H., Ottobrunn (West Germany).

PARAMETRIC TRENDS AND OPTIMIZATION; PRELIMINARY SELECTION OF CONFIGURATION; PROTOTYPE DESIGN AND MANUFACTURE c02

H. Huber *In* AGARD Helicopter Aerodyn. and Dyn. Mar. 1973 55 p refs (For availability see N73-22948 14-01)

The contribution of aerodynamic and dynamic inputs to the design synthesis of rotary wings is discussed. Aerodynamic rotor design is concentrated on disc loading, tip speed, and solidity selection. Rotor airfoil design is examined under the aspects of compressibility and stall problems. Fundamental flapping and inplane frequencies are shown to be the two basic parameters in dynamic rotor design. Methods of developing various trend curves and their interpretation is supplemented by formal and iterative optimization techniques. Author

N73-22959 Westland Helicopters, Ltd., Yeouil (England).

FLIGHT TESTING FOR PERFORMANCE AND FLYING QUALITIES c02

Kieran T. McKenzie *In* AGARD Helicopter Aerodyn. and Dyn. Mar. 1973 15 p (For availability see N73-22948 14-01)

A review is presented of the required approach to flight testing of rotary wing aircraft in the major areas of performance

and flying qualities. Program philosophies, problem areas, techniques of measurement, recording, and analysis are examined and discussed. Some sample measurements and procedures are examined to illustrate approaches. Author

N73-22960# Deutsche Forschungs- und Versuchsanstalt fuer Luft- und Raumfahrt, Brunswick (West Germany). Abteilung Heterogene Stroemungen.
INVESTIGATION OF COMBINED HEAT AND MASS TRANSFER FROM A WET FLAT PLATE IN PARALLEL AIR FLOW FORMING A TURBULENT BOUNDARY LAYER [UNTERSUCHUNG DES GEKOPPELTEN WAERME- UND STOFFUEBERGANGES AN EINER FEUCHTEN EBENEN PLATTEBEI PARALLELER ANSTROEMUNG UND TURBULENTER GRENZSCHICHT]
Klaus-Juergen Schultz 1973 55 p refs In GERMAN; ENGLISH summary Sponsored by Deut. Forschungsgemeinschaft
(DLR-FB-73-11) Avail: NTIS HC $4.75; DFVLR, Porz: 13,50 DM

Combined heat and mass transfer with evaporation of hydrocarbons for a wet flat plate in a parallel air flow forming a turbulent boundary layer were investigated. The influence of flow temperature and velocity, as well as the plate length on the mean heat and mass transfer rates, was confirmed by experiments. The effects of an unwet front part of the plate and the boundary layer were also investigated. Heat transfer rates at the wet plate and at a similar dry plate were compared. The heat and mass transfer rates were computed for the laminar boundary layer. Comparison of results obtained by experiments to computed ones allow confirmation of the validity of the calculation methods applied to engineering purposes. ESRO

N73-22961# ARO, Inc., Arnold Air Force Station, Tenn.
HYPERSONIC LIFTING BODY WINDWARD SURFACE FLOW-FIELD ANALYSIS FOR HIGH ANGLES OF INCIDENCE Final Report, Jul. 1971 - Jul. 1972
John C. Adams, Jr. and William R. Martindale AEDC Feb. 1973 235 p refs
(ARO Proj. VW5206)
(AD-756499; ARO-VKF-TR-72-128; AEDC-TR-73-2) Avail: NTIS CSCL 01/3

Formulation and application of a windward surface flow-field (inviscid and viscous) analysis is presented for general lifting body configurations at high angles of incidence under hypersonic perfect gas conditions. The technique applies a strip theory concept, leading to an infinite extent yawed body treatment applied in the windward surface crossflow plane for both the inviscid and viscous (boundary layer) flow fields. The boundary-layer analysis is based on the governing equations for yawed blunt body boundary layers. Author (GRA)

N73-22962*# Naval Ordnance Lab., White Oak, Md.
AERODYNAMIC DATA OBTAINED FROM FREE-FLIGHT MODEL FIRINGS OF TWO BLUNT-NOSED CONICAL CONFIGURATIONS AT HYPERSONIC VELOCITIES IN MIXTURES OF AIR, NITROGEN, AND CARBON DIOXIDE
Leonard E. Crogan 29 Sep. 1972 61 p ref Sponsored by NASA
(NASA-CR-131986; AD-752764; NOLTR-72-236) Avail: NTIS HC $5.25 CSCL 19/1

Two blunt-nosed conical configurations were investigated at hypersonic velocities to observe the effect of several gas mixtures on their drag and stability characteristics. Author (GRA)

02 AIRCRAFT

Includes fixed-wing airplanes, helicopters, gliders, balloons, ornithopters, etc; and specific types of complete aircraft (e.g., ground effect machines, STOL, and VTOL); flight tests; operating problems (e.g., sonic boom); safety and safety devices; economics; and stability and control. For basic research see: 01 Aerodynamics. For related information see also: 31 Space Vehicles; and 32 Structural Mechanics.

N73-22963 Engineering Sciences Data Unit, London (England).
INFORMATION ON THE USE OF DATA ITEMS ON ROLLING MOMENT DERIVATIONS OF AN AEROPLANE
Oct. 1972 2 p
(ESDU-06.01.00-Amend-A-C) Copyright. Avail: Issuing Activity

The rolling moment derivatives of an aircraft due to rolling, yawing, and sideslip are discussed. The rolling moments are further defined with respect to the effects of wing planform, fin and rudder configurations, and dihedral and wing-body arrangement. It is stated that good approximation of the aerodynamic characteristics may be obtained by determining the effects of various parts of the aircraft separately and then combining the part derivatives to obtain the overall derivative. Author

N73-22964*# Boeing Co., Philadelphia, Pa. Vertol Div.
V/STOL TILT ROTOR AIRCRAFT STUDY. VOLUME 1: CONCEPTUAL DESIGN OF USEFUL MILITARY AND/OR COMMERCIAL AIRCRAFT
Mar. 1972 145 p refs Sponsored in part by Army 4 Vol. (Contract NAS2-6598)
(NASA-CR-114437; D222-10016-1) Avail: NTIS HC $9.25 CSCL 01C

The conceptual designs of four useful tilt-rotor aircraft for the 1975 to 1980 time period are presented. Parametric studies leading to design point selection are described, and the characteristics and capabilities of each configuration are presented. An assessment is made of current technology status, and additional tilt-rotor research programs are recommended to minimize the time, cost, and risk of development of these vehicles. Author

N73-22965*# Boeing Co., Philadelphia, Pa. Vertol Div.
V/STOL TILT ROTOR AIRCRAFT STUDY. VOLUME 2: PRELIMINARY DESIGN OF RESEARCH AIRCRAFT
Mar. 1972 343 p refs Sponsored in part by Army 4 Vol. (Contract NAS2-6598)
(NASA-CR-114438; D222-10016-2-Vol-2) Avail: NTIS HC $19.25 CSCL 01C

A preliminary design study was conducted to establish a minimum sized, low cost V/STOL tilt-rotor research aircraft with the capability of performing proof-of-concept flight research investigations applicable to a wide range of useful military and commercial configurations. The analysis and design approach was based on state-of-the-art methods and maximum use of off-the-shelf hardware and systems to reduce development risk, procurement cost and schedules impact. The rotors to be used are of 26 foot diameter and are the same as currently under construction and test as part of NASA Tilt-Rotor Contract NAS2-6505. The aircraft has a design gross weight of 12,000 lbs. The proposed engines to be used are Lycoming T53-L-13B rated at 1550 shaft horsepower which are fully qualified. A flight test investigation is recommended which will determine the capabilities and limitations of the research aircraft. Author

N73-22966# Loughborough Univ. of Technology (England). Dept. of Transport Technology.
A PILOT SURVEY OF SOME EFFECTS OF AIRCRAFT NOISE IN RESIDENTIAL COMMUNITIES NEAR LONDON (HEATHROW) AIRPORT
J. B. Ollerhead Jan. 1973 69 p refs
(TT-7302) Avail: NTIS HC $5.50

A pilot survey (601 interviews) has been undertaken to evaluate methods for measuring disturbance and annoyance caused by aircraft noise together with monetary valuation of noise nuisance. Disturbance is defined as the direct effects of noise which includes intrusion, interference or distraction and annoyance is defined as an indirect effect which may be considered as a subjective response to disturbance. Measurements of perceived disturbance give perhaps a less complete indication of the overall effects of aircraft noise than those of annoyance but they can be expressed in more objective dimensions and they should correlate more highly with physical measures of noise exposure. A preliminary analysis of the results is presented. A non-dimensional noise other coefficient is developed which directly relates noise annoyance to other sources of community dissatisfaction. Author

N73-22967# Loughborough Univ. of Technology (England). Dept. of Transport Technology.
THEORETICAL INVESTIGATIONS OF SUPERSONIC ROTOR NOISE
D. L. Hawkings and M. V. Lowson Dec. 1972 98 p refs
(TT-7213) Avail: NTIS HC $7.00

A theoretical analysis of supersonic rotor noise is presented. The initial noise generation processes are investigated in detail using the Lighthill aerodynamic sound theory, and its subsequent non-linear propagation is accounted for using the Whitham weak shock theory. The combined analysis explains many of the observed features of supersonic rotor noise. Author

N73-22968# Societe Nationale Industrielle Aerospatiale, Paris (France).
CALCULATION OF FEATHERING CHARACTERISTICS IN THE WHIRLWIND FIELD OF AN AIRFOIL WHIRLWIND FIELD OF AN AIRFOIL [CALCUL DES CARACTERISTIQUES D'EMPENNAGES DANS LE CHAMP TOURBILLONNAIRE D'UNE VOILURE]
M. Yermia 17 Oct. 1972 36 p refs In FRENCH Presented at 9th Conf. on Appl. Aerodyn, Paris, 8 and 10 Nov. 1972 and Saint-Cyr-l'Ecole, France, 9 Nov. 1972
(DEP/PRA/NT/88/72) Avail: NTIS HC $4.00

A theoretical determination was made of the effects of a perfect incompressible fluid flow on feathering characteristics in airfoil whirlwinds. Airfoil configuration, whirlwind-wake interaction effects, equilibrium flow, and velocity fields are analyzed.
Transl. by E.H.W.

N73-22969# Aeronautical Research Inst. of Sweden, Stockholm.
DISK APPROXIMATION FOR A HELICOPTER ROTOR IN FORWARD FLIGHT
C. A. Johansson 1972 66 p refs
(FFA-123) Avail: NTIS HC $5.50

A theory is developed for calculation of the induced velocity field of a helicopter rotor in forward flight. The rotor is approximated by a disk of continuous thrust and in-plane force distributions, which are assumed to be known. Its wake is represented by a semi-infinite cylinder of distributed vorticity. It is also suggested how this theory can be used for solving the full rotor problem, when the inflow data are given but the force distribution of the rotor is unknown. A numerical example is calculated. Author

N73-22970# Centre d'Etudes Aerodynamiques et Thermiques, Poitiers (France).
THREE DIMENSIONAL SUPERSONIC FLOW SEPARATION ON A DELTA WING [DECOLLEMENT TRIDIMENSIONNEL SUR UNE AILE DELTA EN ECOULEMENT SUPERSONIQUE]
P. Srinivasan, R. Leblanc, and T. AlziaryDeRoquefort Paris Soc. Natl. Ind. Aerospatiale 1972 32 p refs In FRENCH Presented at 9th Conf. on Appl. Aerodyn., Paris, 8 and 10 Nov. 1972 and Saint-Cyr-l'Ecole, France, 9 Nov. 1972
(Contract DRME-70/145)
Avail: NTIS HC $3.75

An integral method is used to study the effects of interaction and flow separation in three-dimensional boundary layers, and for establishing a point of theoretical approach to the problem. A visualization procedure was used to study the effects of wall flow and wall pressure at Mach numbers 3,4, and 8. Pressure fields, longitudinal flow, and transverse movement were calculated using a bidimensional method. Numerical integration is used to determine wall flow lines in the interaction region and compare visualization results. A delta wing was used for the study.
Transl. by E.H.W.

N73-22971# Societe Nationale Industrielle Aerospatiale, Paris (France).
CRITICAL STUDY OF REPRESENTATIONS OF THE EFFECTS OF WIND GUST ON AIRCRAFT [ETUDE CRITIQUE DE LA REPRESENTATION DES EFFETS DE RAFALES SUR L'AVION]
R. Hirsch, J. J. Perrin, and H. Lethuy 1972 28 p In FRENCH Presented at 9th Conf. on Appl. Aerodyn., Paris, 8 and 10 Nov. 1972 and Saint-Cyr-l'Ecole, France, 9 Nov. 1972
Avail: NTIS HC $3.50

A detailed analysis is presented of the response of STOL type aircraft to wind gusts. The study utilizes fundamental factors of physical mechanisms including transition deflection on the tail assembly, separation of return flow by bending, structural deformation, and lift instability. Equipment specifications necessary for eventual automatic control of lift are discussed.
Transl. by E.H.W.

N73-22972# Societe Nationale Industrielle Aerospatiale, Paris (France).
APPLICATION OF SEVERAL AERODYNAMIC PROBLEMS TO LIGHT AIRCRAFT [QUELQUES PROBLEMES D'AERODYNAMIQUE APPLIQUEE A L'AVION LEGER]
Yves Gardan 1972 8 p In FRENCH Presented at 9th Conf. on Appl. Aerodyn., Paris, 8 and 10 Nov. 1972 and in Saint-Cyr-l'Ecole, France, 9 Nov. 1972
Avail: NTIS HC $3.00

Aerodynamic problems of light aircraft in relation to flight qualities and minimum performance and construction of its engine are discussed. Data cover aircraft stability, longitudinal and transverse control, and response to wing configuration and other design changes. Transl. by E.H.W.

N73-22973# Office National d'Etudes et de Recherches Aerospatiales, Paris (France).
THEORETICAL AND EXPERIMENTAL STUDY OF WING DEFLECTION DURING LOW SPEED FLIGHT AND IN A LARGE INCIDENCE DOMAIN [ETUDE THEORIQUE ET EXPERIMETALE D'UNE AILE EN FLECHE A FAIBLE VITESSE ET DANS UN LARGE DOMAINE D'INCIDENCES]
M. Ledoux and B. Monnerie 1972 25 p In FRENCH Presented at 9th Conf. on Appl. Aerodyn., Paris, 8 and 10 Nov. 1972 and in Saint-Cyr-l'Ecole, France, 9 Nov. 1972
Avail: NTIS HC $3.25

A straight wing model is used to experimentally study three-dimensional flow. The effects of low speed on the wing model was tested in a wind tunnel and results compared to those obtained by calculation. The effects of pressure are also studied. Transl. by E.H.W.

N73-22974# Mitre Corp., McLean, Va.
EXECUTIVE SUMMARY OF THE SHORT HAUL AIR TRANSPORTATION SYMPOSIUM
Apr. 1973 95 p Symp. held in McLean, Va., 10-12 Apr. 1973
(M73-54) Avail: NTIS HC $6.75

The proceedings of a conference on short haul air transport are presented. The subjects discussed are: (1) demand growth and prospects; (2) international trade and economic prospects; (3) urban and environmental impacts, (4) aviation technology prospects; (5) capitalization, finance, and profit; (6) regulation needs and prospects; (7) operations needs and prospects; and (8) airport requirements. Author

N73-22975*# National Aeronautics and Space Administration. Langley Research Center, Langley Station, Va.
NOISE SUPPRESSOR Patent Application
William E. Zorumski, inventor (to NASA) Filed 14 May 1973 13 p
(NASA-Case-LAR-11141-1; US-Patent-Appl-SN-359957) Avail: NTIS HC $3.00 CSCL 20A

The characteristics of a noise suppression system for installation in the inlet and exhaust ducts of a turbofan engine to reduce the level of noise emitted from the engine are presented. The device consists of a number of annular acoustically porous elements installed in the ducts. The elements are designed and located so that a sound wave travelling through one element will be incompatible with a wave travelling through another element. The wave reflection which occurs at the element interfaces cause a reflection and absorption of the sound with reduction in intensity. NASA

N73-22976*# General Dynamics/Fort Worth, Tex. Convair Aerospace Div.
PRELIMINARY WEIGHT AND COST ESTIMATES FOR TRANSPORT AIRCRAFT COMPOSITE STRUCTURAL DESIGN CONCEPTS
30 Mar. 1973 117 p refs

(Contract NAS1-10702)
(NASA-CR-112255) Avail: NTIS HC $8.00 CSCL 01C

Preliminary weight and cost estimates have been prepared for design concepts utilized for a transonic long range transport airframe with extensive applications of advanced composite materials. The design concepts, manufacturing approach, and anticipated details of manufacturing cost reflected in the composite airframe are substantially different from those found in conventional metal structure and offer further evidence of the advantages of advanced composite materials. Author

N73-22977*# Bell Helicopter Co., Fort Worth, Tex.
AN ANALYTICAL STUDY FOR THE DESIGN OF ADVANCED ROTOR AIRFOILS
Larry D. Kemp 29 Mar. 1973 233 p refs
(Contract NASw-2334)
(NASA-CR-112297; Rept-299-099-635) Avail: NTIS HC $13.75 CSCL 01A

A theoretical study has been conducted to design and evaluate two airfoils for helicopter rotors. The best basic shape, designed with a transonic hodograph design method, was modified to meet subsonic criteria. One airfoil had an additional constraint for low pitching-moment at the transonic design point. Airfoil characteristics were predicted. Results of a comparative analysis of helicopter performance indicate that the new airfoils will produce reduced rotor power requirements compared to the NACA 0012. The hodograph design method, written in CDC Algol, is listed and described. Author

N73-22978*# National Aeronautics and Space Administration. Ames Research Center, Moffett Field, Calif.
OBSERVATIONS OF DISK-SHAPED BODIES IN FREE FLIGHT AT TERMINAL VELOCITY
John W. Vorreiter and David L. Tate Mar. 1973 34 p refs
(NASA-TM-X-62262) Avail: NTIS HC $3.75 CSCL 01A

Ten disk-shaped models of a proposed nuclear heat source module were released from an aircraft and observed by radar. The initial launch attitude, spin rate, and mass of the models were varied. Significant differences were observed in the mode of flight and terminal velocity among models of different mass and launch attitudes. The data were analyzed to yield lift and drag coefficients as a function of Reynolds number. The total sea-level velocity of the models was found to be well correlated as a function of mass per unit frontal area. The demonstrated terminal velocity of the modular disk heat source, about 27 m/sec for this specific design, is only 33% of that of existing heat source designs. Author

N73-22979*# Lockheed-Georgia Co., Marietta.
PROGRAM FOR ESTABLISHING LONG TIME FLIGHT SERVICE PERFORMANCE OF COMPOSITE MATERIALS IN THE CENTRAL WING STRUCTURE OF C-130 AIRCRAFT. PHASE 2: DETAILED DESIGN
W. E. Harvill, J. J. Duhig, and B. R. Spencer Apr. 1973 171 p refs
(Contract NAS1-11100)
(NASA-CR-112272) Avail: NTIS HC $10.75 CSCL 01C

The design, fabrication, and evaluation of boron-epoxy reinforced C-130 center wing boxes are discussed. Design drawings, static strength, fatigue endurance, flutter, and weight analyses required for the wing box fabrication are presented. Additional component testing to verify the design for panel buckling and to evaluate specific local design areas are reported. Author

N73-22980# National Transportation Safety Board, Washington, D.C.
A PRELIMINARY ANALYSIS OF AIRCRAFT ACCIDENT DATA, US CIVIL AVIATION, 1972 Special Study, 1972
11 Apr. 1973 54 p
(NTSB-APA-73-1) Avail: NTIS HC $4.75

The record of aircraft accidents which occurred in U.S. Civil Aviation Operations during calendar year 1972 is presented. It includes a statistical recapitulation of all accidents and a brief of each air carrier accident containing the essential items of information. Author

N73-22981*# Kanner (Leo) Associates, Redwood City, Calif.
STOL AIRCRAFT WITH MECHANICAL HIGH-LIFT SYSTEMS COMPARED WITH STOL AIRCRAFT WITH WINGS EQUIPPED WITH BLOWN FLAPS
E.-A. Bielefeldt Washington NASA May 1973 37 p refs Transl. into ENGLISH from Messerschmitt-Boelkow-Blohm bmBh report UH-12-72(o) (West Germany), 20 Sep. 1972 35 p Presented at the 5th Ann. Meeting of the DGLR, 4-6 Oct. 1972
(Contract NASw-2481)
(NASA-TT-F-14895; UH-12-72(o); Paper-72-057) Avail: NTIS HC $4.00 CSCL 01C

Net lifts of modern mechanical auxiliary high-lift systems and blown flaps are compared, as used on STOL aircraft with high surface loads. The possibilities for achieving aerodynamic efficiencies with these high-lift systems are discussed. Aerodynamic system problems and the effects of system weights of different auxiliary high-lift devices on net lift are considered. The net lifts of complex mechanical and blown-flap systems are determined as applied to a STOL aircraft configuration based on a surface loads of 370 kilograms per square meter for which a maximum lift coefficient of about 3.5 is required in the trimmed state. It is found that mechanical high-lift systems are superior to blown flaps in this comparison. Author

N73-22982# Paris Univ. (France). Lab. d'Aerothermique.
PROBLEMS OF BOUNDED AERODYNAMIC AND THERMIC WALL DEFORMATION [PROBLEMES AERODYNAMIQUES ET THERMIQUES LIES AUX DEFORMATIONS DE PAROIS]
Jean Joseph Bernard Soc. Natl. Ind. Aerospatiale 1972 32 p refs In FRENCH Presented at 9th Conf. on Appl. Aerodyn., Paris, 8 and 10 Nov. 1972 and Saint-Cyr-l'Ecole, France, 9 Nov. 1972
Avail: NTIS HC $3.75

Wall deformation, as affected by subsonic, supersonic, and hypersonic flow regimes, is discussed. Problems caused by laminar and turbulent flow are included. Various other factors including flow velocity, laminar transition, pressure and convection coefficients, and bidimensional and tridimensional deformation are outlined. Transl. by E.H.W.

N73-22983# National Transportation Safety Board, Washington, D.C.
SPECIAL STUDY: IN FLIGHT SAFETY OF PASSENGERS AND FLIGHT ATTENDANTS ABOARD AIR CARRIER AIRCRAFT
14 Mar. 1973 43 p refs
(NTSB-AAS-73-1) Avail: NTIS HC $4.25

Nonfatal in-flight injuries of passengers and flight attendants in air carrier operations during the years, 1968 through 1971 are discussed. Injuries caused by turbulence, evasive maneuvers to avoid a collision, and self-initiated injuries are summarized. Conditions, circumstances, and pre-existing factors instrumental in creating a hazardous environment for persons aboard aircraft are examined, as well as types of injuries sustained and the treatment of such injuries. Also examined is the relationship of injuries to passenger seatbelt discipline, structure and design of cabin furnishings, flight attendants' duties, consumption of alcoholic beverages, and the location in the airplane of passengers and flight attendants. Six safety recommendations are presented. Author

N73-22984# Calspan Corp., Buffalo, N.Y.
IN FLIGHT SIMULATION OF MINIMUM LONGITUDINAL STABILITY FOR LARGE DELTA WING TRANSPORTS IN LANDING APPROACH AND TOUCHDOWN. VOLUME 1: TECHNICAL RESULTS Final Report
Richard Wasserman and John F. Mitchell Feb. 1973 129 p refs
(Contracts DOT-FA72WAI-143; F33615-72-C-1388)
(TR-5084-F-1-Vol-1; FAA-RD-73-43-Vol-1; AFFDL-TR-72-143-Vol-1) Avail: NTIS HC $8.50

An in-flight simulation to investigate minimum longitudinal stability for large delta-wing transports in landing approach and touchdown (including ground effect) was conducted using the USAF/Calspan Total In-Flight Simulator (TIFS)airplane. Aerodynamic, inertial and control data for this class of airplane were obtained from a prototype Concorde package supplied by the

FAA. The simulation program involved the examination of 20 configurations by four evaluation pilots. The configurations evaluated were based upon a systematic variation of the longitudinal stability characteristics for this class of airplane. These variations were designed to examine the influence of pitch stiffness, backsideness, pitch damping and nonlinear pitching moment effects on pilot acceptability of minimum longitudinal stability for the landing approach task. A total of 61 evaluations was performed. Author

N73-22985# National Transportation Safety Board, Washington, D.C.
AIRCRAFT ACCIDENT REPORT: SPECTRUM AIR INCORPORATED SABRE MARK 5, N275X, SACRAMENTO EXECUTIVE AIRPORT, SACRAMENTO, CALIFORNIA, 24 SEPTEMBER 1972
24 Sep. 1972 35 p
(NTSB-AAR-73-6) Avail: NTIS HC $3.75

A Sabre Mark 5 aircraft crashed during a rejected takeoff at Sacramento, California Executive Airport on September 24, 1972. The aircraft became airborne twice during the attempted takeoff, but returned to the runway each time. The pilot reported that the aircraft acceleration and control response were normal until a vibration was felt shortly after initial liftoff. The aircraft crashed into a commercial establishment killing 22 persons and injuring 28, including the pilot. The probable cause of the accident was overrotation of the aircraft and subsequent loss of performance. Author

N73-22986 Laboratorium fuer Betriebsfestigkeit, Darmstadt (West Germany).
A STANDARDIZED LOAD SEQUENCE FOR FLIGHT SIMULATION TESTS ON TRANSPORT AIRCRAFT WING STRUCTURES
J. B. DeJonge, D. Schuetz, H. Lowak, and J. Schijve Mar. 1973 51 p refs Prepared in cooperation with Natl. Lucht en ruimtevaartlab., Amsterdam
(LBF-Bericht-FB-106; NLR-TR-73029-U) Avail: NTIS HC $4.75

A description is given of the development of a standardized load sequence which may be considered to be representative for the load history of the wing root of transport aircraft. Adoption of this standardized sequence is proposed for various aeronautical fatigue testing purposes. Author

N73-22987# Technische Hochschule, Aachen (West Germany). Inst. Fuer Luft- und Raumfahrt.
ACOUSTIC FEEDBACK OF A SUBSONIC AND SUPERSONIC FREE JET IMPINGING ON AN OBSTACLE [AKUSTISCHE RUECKKOPPLUNGSERSCHEINUNGEN AM UNTER- UND UEBERSCHALLFREISTRAHL, DER AUF EINEN STOERKOERPER TRIFFT]
Guenther Neuwerth 31 Oct. 1972 37 p refs In GERMAN; ENGLISH summary Presented at the 5th DGLR Annual Meeting, Berlin, 4-6 Oct. 1972
(DLR-FB-72-72) Avail: NTIS HC $4.00; DFVLR, Porz. 13,40 DM

Stationary wave pattern in the jet core, ring vortices in the jet boundary, and high intensity discrete frequencies in the noise and turbulence spectrum are observed during circular subsonic free jet impinging on an obstacle. The sound pressure level is enlarged by about 10 db. All these phenomena are explained by the feedback between the flow and the pressure field generated. The Strouhal numbers were determined as a function of Mach number, jet temperature, nozzle diameter, and distance between the obstacle and the nozzle. A pressure wave in the jet core responsible for feedback was investigated. ESRO

N73-22988# Ballistic Research Labs., Aberdeen Proving Ground, Md.
EFFECTS OF REDUNDANCY ON SURVIVAL OF CRITICAL AVIONICS EQUIPMENT
Keats A. Pullen Jan. 1973 36 p refs
(DA Proj. 1T6-62708-A-068)
(AD-757152; BRL-MR-2266) Avail: NTIS CSCL 09/5

The design of simple circuits capable of keeping communications equipment in operation under conditions of failure of vital sections or sub-units of a system are described. Analyses are included which indicate possible routes for improvement of equipment survivability in a battlefield-type environment. Author (GRA)

N73-22989# Rochester Applied Science Associates, Inc., N.Y.
DETERMINATION OF THE AERODYNAMIC CHARACTERISTICS OF VORTEX SHEDDING FROM LIFTING AIRFOILS FOR APPLICATION TO THE ANALYSIS OF HELICOPTER NOISE Final Report, 18 Jun. 1969 - 31 Jan. 1973
S. Gene Sadler, H. Kevin Johnson, and Timothy D. Evans Feb. 1973 76 p refs
(Contract DAHC04-69-C-0090; DA Proj. 2O0-61102-B-33G)
(AD-757167; RASA-73-02; AROD-8695-2-E) Avail: NTIS CSCL 01/3

A study of vortex shedding from a lifting airfoil has been carried out. The objective of the study was to determine the important parameters affecting vortex shedding from airfoils for application to the study of vortex noise in helicopters. The study was conducted in the UARL acoustic research wind tunnel. Measurements of far-field noise and surface pressure fluctuations were obtained and analyzed for a NACA 0012 airfoil. (Author Modified Abstract) GRA

N73-22990# Naval Postgraduate School, Monterey, Calif.
THE NUMERICAL SOLUTION AND ANALYSIS OF AIRPLANE SPIN EQUATIONS MODELED IN A FIXED COORDINATE SYSTEM M.S. Thesis
Robert Louis Champoux Dec. 1972 140 p refs
(AD-757257) Avail: NTIS CSCL 01/3

Three forms of the airplane spin equations of motion, derived by Buehler form the basis for the development of a computer program designed to seek dynamically stable equilibrium solutions of a spinning aircraft. The program incorporates two solution techniques: one based upon Euler integration, the other, a version of minimization by gradient search. Secondary programs are developed to generate power off glide parameters for use in the validation of the equations of motion, and evaluate equation residuals obtained from a grid of initial conditions over the potential solution space. F-111 and F-4 aerodynamic force and moment models were utilized to evaluate the solution methods and equations of motion. The numerical results indicate that the F-111 and F-4 data are not representative of the actual aircraft and, therefore, it is highly unlikely that dynamically stable equilibrium solutions can be achieved from these models. (Author Modified Abstract) GRA

N73-22991# Cranfield Inst. of Technology (England).
ANALYSIS OF TAXIING INDUCED VIBRATIONS IN AIRCRAFT BY THE POWER SPECTRAL DENSITY METHOD Final Report, May - Dec. 1971
C. L. Kirk Wright-Patterson AFB, Ohio AFFDL Jan. 1973 44 p refs
(Contract F44620-71-C-0084; AF Proj. 1370)
(AD-757283; AFFDL-TR-72-74) Avail: NTIS CSCL 01/3

Taxiing induced vibrations in large aircraft due to runway and taxiway unevenness have been recognized as a significant factor in causing airframe metal fatigue damage and dynamic stressing, as well as discomfort for the crew and passengers. Vibration of the landing gear also causes seal wear with subsequent leakage of air and hydraulic fluid. The report presents an analytical method of determining the random vibration response of a flexible aircraft caused by runway unevenness transmitted through the main landing gear struts. The aircraft used in the computation of vibration response is the Boeing KC-135A (Stratotanker) in the fully loaded configuration (324,000 lb) (146,963 kg). GRA

N73-22992# Army Electronics Command, Fort Monmouth, N.J.
AIRFRAME EXCITATION OF THE LOH-6A HELICOPTER AT HF (2-30 MHz)
Charles M. DeSantis Feb. 1973 55 p refs
(DA Proj. 1T0-61102-B-31A)
(AD-757143; ECOM-4077) Avail: NTIS CSCL 01/3

The report describes the results of a four-month investigation of the controlled airframe excitation of helicopters in the 2 - 30 MHz frequency range. Two methods of excitation are considered: magnetic and electric. Magnetic excitation is achieved by using a pair of coils placed symmetrically on the tail section

of the aircraft to induce longitudinal currents in the aircraft skin. Electric excitation is achieved by covering the rear section of the aircraft with a metallic sleeve to create a high impedance gap which can be driven with a voltage source. Measurements of the impedance, radiation patterns, bandwidth, and efficiency were made on a 5:1 scale model of the LOH-6A helicopter in the frequency range 10 - 150 MHz. Author (GRA)

N73-22993# Boeing Co., Seattle, Wash.
STOL TRANSPORT THRUST-REVERSER/VECTORING PROGRAM, VOLUME 1 Final Report, Jul. 1971 - Nov. 1972
John E. Petit and Michael B. Scholey Feb. 1973 304 p refs
(Contract F33615-71-C-1850; AF Proj. 643A)
(AD-756860; AFAPL-TR-72-109-Vol-1) Avail: NTIS CSCL 01/3

Existing data were reviewed for application to computer programs to predict TR/TV performance and evaluating TR/TV influence on the total airplane system. Three programs were developed: (1) Jet Trajectory and Spreading Program - to predict the shape and trajectory of the TR/TV exhaust plume; (2) Reingestion Prediction Program - to predict the onset of reingestion; and (3) TR and TV System Performance and effect TR/TV operation on engine stability margin. Static tests were conducted to determine multibearing thrust vectoring nozzle performance and blocker door geometry effects on annular cascade thrust reverser performance. Results were incorporated in the TR and TV System Performance Program. The programs provide relatively simple design tools to evaluate TR/TV performance and to determine potential exhaust flow interference and reingestion data to STOL transport configurations is limited. Low speed wind tunnel testing is recommended to obtain this type of data. Author (GRA)

N73-22994# Boeing Co., Seattle, Wash.
STOL TRANSPORT THRUST REVERSER/VECTORING PROGRAM, VOLUME 2 Final Report, Jul. 1971 - Nov. 1972
John E. Petit and Michael B. Scholey Feb. 1973 207 p refs
(Contract F33615-71-C-1850; AF Proj. 643A)
(AD-756861; AFAPL-TR-72-109-Vol-2) Avail: NTIS CSCL 01/3

Design studies were conducted of thrust reverser and thrust vectoring systems for STOL tactical transports to evolve systems properly integrated with the aircraft. The studies included configuration design, performance, and weight analyses of feasible thrust reverser and thrust vectoring concepts. Test plans were developed for static tests of the most promising concepts. Following Air Force approval of the test plans, test model hardware were fabricated. Model tests were conducted of a fan thrust reverser that exhausts all of the fan flow through cascades installed in the upper 180 degrees sector of the nacelle, and an external deflector/target TR/TV system that combines the functions of thrust vectoring and reversing into a single mechanism. Scaling relationships were used to correct the data to full-scale performance, and data correlations were developed for the external/target model as a function of geometric parameters and nozzle pressure ratio. Author (GRA)

N73-22995# General Dynamics/Fort Worth, Tex. Convair Aerospace Div.
COMPOSITE WING FOR TRANSONIC IMPROVEMENT. VOLUME 3: STRUCTURAL RELIABILITY STUDIES Final Technical Report
Sherrell D. Manning, Glenn H. Lemon, and Max E. Waddours Nov. 1972 244 p refs
(Contract F33615-70-C-1242)
(AD-756893; AFFDL-TR-71-24-Vol-3) Avail: NTIS CSCL 01/3

Studies were conducted to establish the reliability characteristics of large scale bonded joints applicable to an advanced composite wing. A combined experimental/analytical approach was used to examine the residual strength/lifetime characteristics of a boron-epoxy-to-titanium scarf joint. The implications of joint reproducibility and fatigue characteristics on structural reliability and design criteria have been studied. The results correlate strength/lifetime characteristics, define the joint fatigue failure process, and establish the required technology for proceeding with reliability-based design for bonded joints. (Author Modified Abstract) GRA

N73-22996 Bendix Corp., South Bend, Ind. Energy Controls Div.
FILAMENT COMPOSITE MATERIAL LANDING GEAR PROGRAM, VOLUME 1 Final Report, 1 Apr. 1969 - 1 Feb. 1972
Aug. 1972 235 p refs
(Contract F33615-69-C-1558; AF Proj. 1368; AF Proj. 1369)
(AD-756922; AFFDL-TR-72-78-Vol-1) Avail: NTIS CSCL 01/3

The objective of this program was to explore the utility of boron composite materials in aircraft landing gear construction. The contract work statement required the design, fabrication and test of a boron composite material landing gear assembly interchangeable in both geometry and performance with the main landing gear of the A-37B aircraft. The use of BIRSIC (Registered)-aluminum and boron epoxy materials was explored. Hardware designs were evolved for both materials. One full size landing gear assembly was tested. This assembly was composed of a boron epoxy outer cylinder, inner cylinder and side brace. All attachment fittings were metallic. The assembly was tested for hydraulic pressure containment and static structural strength in the Bendix laboratories. (Author Modified Abstract) GRA

N73-22997# Bendix Corp., South Bend, Ind. Energy Controls Div.
FILAMENT COMPOSITE MATERIAL LANDING GEAR PROGRAM, VOLUME 2 Final Report, 1 Apr. 1969 - 1 Feb. 1972
Aug. 1972 279 p refs
(Contract F33615-69-C-1158; AF Proj. 1368; AF Proj. 1369)
(AD-756923; AFFDL-TR-72-78-Vol-2) Avail: NTIS CSCL 01/3

For abstract, see N73-22996. GRA

N73-22998# United Aircraft Corp., East Hartford, Conn.
LIFTING SURFACE THEORY FOR STATICALLY OPERATING PROPELLERS Final Report, May 1971 - Sep. 1972
James C. Murray and Franklin O. Carta Dec. 1972 124 p refs
(Contract F33615-71-C-1430; AF Proj. 3066)
(AD-757264; AFAPL-TR-72-100) Avail: NTIS CSCL 01/3

A method was derived and a computer program formulated which utilizes a vortex-lattice lifting surface representation to model a statically operating propeller and to compute its performance. The computer program has been written to yield propeller performance characteristics for a prescribed blade geometry (the direct problem) or to yield blade camber distribution (the indirect problem). All of the results described were obtained for the direct problem. Performance characteristics, including propeller thrust and torque coefficients, were computed for three propeller configurations and were compared with test data and with results computed using lifting line theory. (Author Modified Abstract) GRA

N73-22999# Boeing Commercial Airplane Co., Seattle, Wash.
EXPLORATORY DEVELOPMENT ON APPLICATION OF RELIABILITY ANALYSIS TO AIRCRAFT STRUCTURES CONSIDERING INTERACTION OF CUMULATIVE FATIGUE DAMAGE AND ULTIMATE STRENGTH Final Report, 16 Nov. 1970 - 15 Mar. 1972
I. C. Whittaker and S. C. Saunders Jan. 1973 52 p refs
(Contract F33615-71-C-1134; AF Proj. 7351)
(AD-757529; D6-60165; AFML-TR-72-283) Avail: NTIS CSCL 01/3

An analysis method for determining the reliability of airplane structures, subjected to the cumulative and maximum operational loads and the resultant interaction of fatigue damage and strength, has been investigated. The design variables include the central tendency values of the fatigue performance, that is, the average lives to initiation and the growth of a major crack, and the effect of the crack on structural strength. Other variables include the standard operational procedure of periodic inspection of the structure and its repair when found to be damaged. Functions, based on the length of the fatigue crack, are used to describe both the residual strength of the structure and the probability of the crack being detected and the cracked structure being repaired. The times to initiation of a crack and the later time when the crack becomes critical, i.e., unstable, are taken

as random variables. The derived reliability model considers that at any time the structure is either failed or unfailed. (Author Modified Abstract) GRA

N73-23000# United Aircraft Corp., East Hartford, Conn. Research Labs.

NONDESTRUCTIVE HOLOGRAPHIC TECHNIQUES FOR STRUCTURES INSPECTION Annual Technical Report, 1 Jul. 1971 - 30 Apr. 1972

R. K. Erf, J. P. Waters, R. M. Gagosz, F. Michael, and G. Whitney Oct. 1972 140 p refs

(Contract F33615-71-C-1874)

(AD-757510; L991208-12; AFML-TR-72-204) Avail: NTIS CSCL 01/3

The program is investigating the feasibility of using holographic interferometry for the inspection of large aircraft structures in a manufacturing or maintenance environment. The work comprised the following: (1) An investigation of various problems to be encountered in technically difficult physical environments as a result of ambient lighting, vibration and suspended aerosols. (2) An evaluation of the effects that various surface finishes have on the holographic construction process. (3) The development of the theory required to relate holographic records to the strain patterns and areas of maximum strain present on large structures. (4) Successful application of both continuous-wave (cw) and pulsed laser systems to time-averaged interferometric holography of composite compressor blades subjected to ultrasonic stressing. (Author Modified Abstract) GRA

N73-23001# Naval Air Development Center, Warminster, Pa. Air Vehicle Technology Dept.

HIGH VOLTAGE DC AIRCRAFT SYSTEM DEVELOPMENT Progress Report

R. Howard Ireland 23 Feb. 1973 21 p refs

(AD-757646; NADC-73035-30) Avail: NTIS CSCL 01/3

The report presents the advantages of a high voltage dc aircraft electrical system over conventional ac systems, discusses several conceptual distribution system designs, and summarizes the current status of the high voltage dc development program. Author (GRA)

N73-23002# Lear Siegler, Inc., Santa Monica, Calif. Astronic Div.

FEASIBILITY STUDY FOR AN ADVANCED DIGITAL FLIGHT CONTROL SYSTEM (DIGIFLIC). VOLUME 1: SUMMARY, ANALYSIS, AND SYSTEM STUDIES. VOLUME 2: SOFTWARE, SPECIFICATION, SIMULATION STUDIES, AND APPENDICES Final Report, Sep. 1971 - Aug. 1972

M. L. Sutton, W. J. Hasson, and G. M. Soderlund Oct. 1972 490 p refs

(Contract N62269-72-C-0142)

(AD-757271; ADR-773-Vol-1-2) Avail: NTIS CSCL 01/3

The digital flight control system (DIGIFLIC) program is an advanced development program of which the principle objective was to study the feasibility of advanced flight control using a digital processor as the main computational element. The studies and analyses conducted during this program resulted in the determination of a set of basic system requirements which could be implemented using present day technology. Investigation of future technology showed that significant advances can be expected which will reduce the size, weight and power required for such a flight control system. The results of these studies are contained in two volumes. Volume 1 contains a detailed summary of the objectives and results, analytical studies and system studies. Volume 2 contains the software studies, system specification, simulation studies and appendices. (Author Modified Abstract) GRA

N73-23003# National Aeronautical Establishment, Ottawa (Ontario).

A DETERMINISTIC MODEL OF SONIC BOOM PROPAGATION THROUGH A TURBULENT ATMOSPHERE

B. H. K. Lee and H. S. Ribner (Toronto Univ.) Nov. 1972 24 p refs

(AD-756790; NAE-LR-566; NRC-12981) Avail: NTIS CSCL 20/1

The propagation of a weak normal shock wave through a turbulent atmosphere is studied in terms of an idealized model. The turbulent field is assumed to be weak and represented by the superposition of two inclined shear waves of opposite inclination to the mean flow. The resulting flow is of a cellular nature. The cells are rectangular in shape and the sense of rotation of the flow alternates from cell to cell. If the angles made by the normal of the incident shear waves with the direction of the mean flow are greater than some critical value an exponentially decaying pressure wave is generated behind the shock. Spiked or rounded waveforms are obtained by adding or subtracting this pressure wave from the steady state pressure field. An illustrative example for a mean flow Mach number of 1.0005 is considered. Author (GRA)

N73-23004# Naval Ship Research and Development Center, Bethesda, Md.

COLLISION PROTECTION FOR THE ARCTIC SURFACE-EFFECT VEHICLE

William E. Gilbert Feb. 1973 82 p refs

(ARPA Order 1676)

(AD-758359; NSRDC-3885) Avail: NTIS CSCL 13/6

Collision protection is studied for the Advanced Research Projects Agency, concerning the proposed Arctic surface-effect vehicle (ASEV). The approach to collision protection is presented, and various energy absorbing concepts are investigated and evaluated for their possible use in protecting the ASEV in ice-obstacle impacts. Schemes being investigated are the air bag, foam-core sandwich panels, energy-absorbing steering columns, inverting and torsional tubes, fluid dispersal shock absorbers, and tubes which buckle intextensionally in axial compression. Author (GRA)

N73-23005# School of Aerospace Medicine, Brooks AFB, Tex.

AEROMEDICAL FACTORS IN MIDAIR COLLISIONS Aeromedical Review

Royce Moser, Jr. Mar. 1973 21 p refs

(AD-758189; SAM-Review-2-73; SAM-TR-73-7) Avail: NTIS CSCL 01/12

Midair collisions continue to be a serious hazard in Air Force flight operations. Various aeromedical factors affect one's ability to detect another aircraft in time to avoid a collision. The review discusses these factors and illustrates the role of these factors in an accident. It also considers the actions the crewmember should take to obtain the maximum benefit from the capabilities he does possess and thus reduce the risk of a midair collision. Author (GRA)

N73-23006# National Transportation Safety Board, Washington, D.C.

AIRCRAFT ACCIDENT REPORT: CESSNA 182, N70586, DULUTH INTERNATIONAL AIRPORT, DULUTH, MINNESOTA, 8 NOVEMBER, 1972

26 Apr. 1973 12 p

(NTSB-AAR-73-10) Avail: NTIS HC $3.00

The crash of a Cessna 182 aircraft near Duluth, International Airport, Duluth, Minnesota on 8 November, 1972 is reported. The crash occurred while attempting a precision radar approach to the airport during instrument flying conditions. The probable cause of the accident was considered to be the formation of ice on the aircraft which was not equipped with deicing or antiicing equipment. Author

N73-23007# Bell Helicopter Co., Fort Worth, Tex.

TRADEOFF STUDY FOR EXTENDED LIFE HELICOPTER TRANSMISSION Technical Report, 1 Jul. 1970 - 16 Apr. 1971

Charles W. Bowen and Richard D. Walker Ft. Eustis, Va. Army Air Mobility R and D Lab. Nov. 1972 242 p refs

(Contract DAAJ02-70-C-0053)

(AD-758465; BHC-299-099-492; USAAMRDL-TR-72-40) Avail: NTIS CSCL 13/9

The report presents the results of a design tradeoff study conducted to determine the operational cost impact of extending and overhaul life of the drive train components from 1200 hours to 3000 and 6000 hours on future Army helicopters. Pertinent Army and BHC publications were reviewed to determine time between overhaul (TBO) limiting factors. An analytical review was also made of a mission profile study conducted on monitored AH-1G, UH-1H, and UH-1C helicopters in Viet Nam to determine

an appropriate usage rate, power spectrum, and flight length spectrum for this study. (Author Modified Abstract) GRA

N73-23008# Boeing Co., Renton, Wash. Commercial Airplane Group.
DEVELOPMENT OF TITANIUM AND STEEL FATIGUE VARIABILITY MODEL FOR APPLICATION OF RELIABILITY ANALYSIS APPROACH TO AIRCRAFT STRUCTURES Final Report, 16 Nov. 1970 - 15 Mar. 1972
I. C. Whittaker Wright-Patterson AFB, Ohio AFML Oct. 1972 114 p refs
(Contract F33615-71-C-1134; AF Proj. 7351)
(AD-758219; D6-60164; AFML-TR-72-236) Avail: NTIS CSCL 01/3

An investigation of the fatigue performance test scatter in titanium alloys and steels was made with the intent of identifying their variability in terms of a distribution and its shape parameter. The two-parameter Weibull distribution was selected for matching the fatigue variability of these two materials. About 1200 groups of titanium alloy and 800 groups of steels were collected and analyzed to determine the feasibility of establishing a typical distributional Weibull shape parameter for these materials. A Weibull distribution shape parameter of 3.0 is suggested for titanium alloys and those steels with a 240-ksi strength level or less. Steels having greater than a 240-ksi strength level seem better represented by a shape parameter of 2.2. In a further study, the choice of a distribution most aptly matching fatigue variability was explored with the use of previously collected extensive aluminum alloy and the titanium alloy data. (Author Modified Abstract) GRA

N73-23009# Naval Air Development Center, Warminster, Pa. Crew Systems Dept.
G PROTECTIVE AIRCRAFT SEATS, WITH SPECIAL CONSIDERATION GIVEN TO PELVIS AND LEGS ELEVATING (PALE) SEATS
Harald J. VonBeckh 1 Oct. 1972 52 p refs
(MF51524005)
(AD-756630; NADC-72262-CS) Avail: NTIS CSCL 01/3

The author is developing a crew seat which achieves the supine position, not by reclining the seat-back, but by elevating the pelvis and the legs forwards-upwards, while the head and the shoulders barely move. In order to differentiate this type of supinating seat from reclining seats, it is named PALE (Pelvis and Legs Elevating) seat. Author (GRA)

N73-23010# Air Force Materials Lab., Wright-Patterson AFB, Ohio.
VIBRATION ANALYSIS OF CURVED SKIN-STRINGER STRUCTURES HAVING TUNED ELASTOMERIC DAMPERS Ph.D. Thesis - Ohio State Univ. Technical Report, Mar. 1968 - Mar. 1972
John P. Henderson Oct. 1972 146 p refs
(AF Proj. 7351)
(AD-758220; AFML-TR-72-240) Avail: NTIS CSCL 01/3

The steady state vibration response of curved skin-stringer structure is analyzed through the application of transfer matrix techniques. Previous transfer matrix analyses of similar structures are improved through the development of a technique for generating the transfer matrix for a curved panel directly from the matrix differential equation, representing eight first order linear differential equations, for an appropriate shell theory. In addition, the effects of stringer stretching and finite stringer width are analyzed. Specifically, the analysis is demonstrated on a structure consisting of a row of five cylindrically curved panels with constant radius of curvature, stiffened by stringers parallel to the generators and simply supported by frames normal to the stringers at the edges. (Author Modified Abstract) GRA

N73-22950 Boeing Co., Philadelphia, Pa. Vertol Div.
BASIC AERODYNAMICS AND PERFORMANCE OF THE HELICOPTER
W. Z. Stepniewski *In* AGARD Helicopter Aerodyn. and Dyn. Mar. 1973 62 p refs (For availability see N73-22948 14-01)

N73-22953 Loughborough Univ. of Technology (England).
HELICOPTER NOISE: ANALYSIS - PREDICTION AND METHODS OF REDUCTION
Martin V. Lowson *In* AGARD Helicopter Aerodyn. and Dyn. Mar. 1973 37 p refs (For availability see N73-22948 14-01)

N73-22958 Messerschmitt-Boelkow-Blohm G.m.b.H., Ottobrunn (West Germany).
PARAMETRIC TRENDS AND OPTIMIZATION; PRELIMINARY SELECTION OF CONFIGURATION; PROTOTYPE DESIGN AND MANUFACTURE
H. Huber *In* AGARD Helicopter Aerodyn. and Dyn. Mar. 1973 55 p refs (For availability see N73-22948 14-01)

N73-22959 Westland Helicopters, Ltd., Yeouil (England).
FLIGHT TESTING FOR PERFORMANCE AND FLYING QUALITIES
Kieran T. McKenzie *In* AGARD Helicopter Aerodyn. and Dyn. Mar. 1973 15 p (For availability see N73-22948 14-01)

N73-23889 Saab Aircraft Co., Linkoping (Sweden). Systems and Avionics Dept.
SOME DEVELOPMENT TRENDS IN THE INTEGRATION OF ELECTRONIC SYSTEMS IN THE SWEDISH AIRCRAFT 37 VIGGEN
Bengt Sjoebert *In* AGARD Automation in Manned Aerospace Systems Mar. 1973 8 p (For availability see N73-23881 14-31)

N73-23898 Royal Aircraft Establishment, Bedford (England).
MANUAL LANDING IN FOG
R. R. Newbery *In* AGARD Automation in Manned Aerospace Systems Mar. 1973 19 p refs (For availability see N73-23881 14-31)

N73-23979* Jet Propulsion Lab., Calif. Inst. of Tech., Pasadena.
HELICOPTER VISUAL AID SYSTEM
R. L. Baisley *In its* Quart. Tech. Rev., Vol. 2, No. 4 Jan. 1973 p 72-86 ref (For availability see N73-23970 14-34) CSCL 01C

03 AUXILIARY SYSTEMS

Includes fuel cells, energy conversion cells, and solar cells; auxiliary gas turbines, hydraulic, pneumatic and electrical systems; actuators; and inverters. For related information see also: 09 Electronic Equipment; Nuclear Engineering; and 28 Propulsion Systems.

N73-23011*# Scientific Translation Service, Santa Barbara, Calif.
UTILIZATION OF WIND POWER BY MEANS OF ELEVATED WIND POWER PLANTS
F. Kelinhenz Washington NASA May 1973 30 p refs Transl. into ENGLISH from Technik (East Berlin), v. 2, no. 12, Dec. 1947 p 517-523
(NASA-TT-F-14903) Avail: NTIS HC $3.50 CSCL 13B

Exploitation of wind power by power plants at high altitudes is considered. A design of a wind power plant is proposed and its efficiency and economy in the framework of present conditions in Germany is demonstrated. Although costs are higher than for a coal fired steam plant, they compare favorably with hydroelectric power plants and the saving of coal is a great advantage. The erection of an experimental plant is recommended. Author

N73-23012*# Kanner (Leo) Associates, Redwood City, Calif.
EFFECT OF ZINC ON THE FUNCTION OF AN ACID ELECTRODE
M. Cenek and O. Kouril Washington NASA May 1973 40 p refs Transl. into ENGLISH of "Vliv Zinku na Funkci kyslikove Elektrody" Brno, Czechoslovakia, 1972 33 p
(Contract NASw-2481)
(NASA-TT-F-14922) Avail: NTIS HC $3.00 CSCL 10C

The results are summarized of a study of the preparation, activation, and a number of other properties of an acid cathode prepared from an Ag2CO3/Zn/ PTFE mixture. A two-layer electrode was used to obtain better three-phase contact of the electrolyte, oxygen, and catalyst. It was found that the use of a mixture whose composition is electronegative metal / silver catalyst / plastic has a more general character, which makes it

possible to produce electrodes with good electrochemical properties and a long service life. Author

N73-23013# Argonne National Lab., Ill. Engineering and Technology Div.
INVESTIGATION OF LIQUID METAL MAGNETOHYDRODYNAMIC POWER SYSTEMS Annual Report, 1 Nov. 1970 - 15 Apr. 1972
Michael Petrick, W. E. Amend, H. C. Stevens, and P. Dauzvardis Dec. 1972 157 p refs
(Contract NAonr-12-70; NR Proj. 274-109)
(AD-757065; ANL/ETD-72-06) Avail: NTIS CSCL 10/2

Detailed cycle and component analyses were carried out on liquid-metal MHD energy conversion systems to establish realistic performance limits, identify important system parameters, determine constraints imposed upon the parameters by the cycle and to identify and evaluate critical problem areas that require research and development programs. (Author Modified Abstract) GRA

N73-23014# Magnetic Corp. of America, Waltham, Mass.
DEVELOPMENT OF PULSED HIGH ENERGY INDUCTIVE ENERGY STORAGE SYSTEMS, VOLUME 1 Technical Report, Apr. 1971 - Apr. 1972
Edward J. Lucas, William F. B. Punchard, and Richard J. Thome Dec. 1972 231 p
(Contract F33615-71-C-1454; AF Proj. 3145)
(AD-755359; AFAPL-TR-72-38-Vol-1) Avail: NTIS CSCL 10/2

Major problems associated with the design of a repetitively pulsed 100 kJ energy storage system are explored and solutions presented. Recommendations as to the design of future systems are made. Based on the results of a theoretical analysis into loss mechanisms in copper/superconductor composites, a braid composed of 4.5 x 10 to minus 3rd power inch diameter strands was selected for further investigation. Coils having stored energies of about 1 and 10 kJ were constructed from this braid and loss measurements made while the coils were being repetitively pulsed at rates of 1 and 5 pulses per second. Author (GRA)

N73-23015# Army Foreign Science and Technology Center, Charlottesville, Va.
PERFORMANCE RELIABILITY CALCULATION FOR A MODULAR SOLAR THERMOELECTRIC GENERATOR
Yu. N. Malevskii 10 Jan. 1973 9 p refs Transl. into ENGLISH from Geliotekhnika, Akad. Nauk Uz. SSR (Tashkent), no. 1, 1971 p 16-20
(AD-757087; FSTC-HT-23-1434-72) Avail: NTIS CSCL 10/2

Analysis is given of the overall reliability of a solar energy converter unit composed of thermoelectric modules, as a function of the reliability of individual photocells and component modules. Expressions are given to determine the reliability of various module circuit designs having the modules in series, parallel and combined connections. The usefulness of redundancy in these designs is noted. Suggestions are given concerning the selection of module circuit designs most suitable for given operational requirements. Author (GRA)

N73-23016# Army Foreign Science and Technology Center, Charlottesville, Va.
OPTIMIZATION OF CONSTRUCTION OF THERMOELECTRIC COOLING BATTERIES
V. S. Martynovskii 29 Dec. 1972 10 p refs Transl. into ENGLISH from Kholodl. Tekhn. (Moscow), no. 2, 1970 p 31-35
(AD-757467; FSTC-HT-23-1274-72) Avail: NTIS CSCL 10/2

The Russian investigation confirms the advisability of a substantial distribution of thermoelements when the condition of heat emission is unfavorable. The proposed construction of thermobattery provides for not only a substantial increase of power efficiency but also for a considerable lowering of the amount of semiconductor materials in thermobatteries owing to the possibility of using short thermoelements. (Author Modified Abstract) GRA

N73-23017# Gulton Industries, Inc., Hawthorne, Calif. Engineering Magnetics Div.
MAINTENANCE FREE BATTERY SYSTEM, MODEL NO. EMBC114C. BATTERY SYSTEM, SEALED CELL, NICKEL CADMIUM, INTEGRAL CHARGE CONTROL, AIRCRAFT Final Report
Thomas W. Grasmehr, William Newman, and Thomas Pierce Dec. 1972 288 p refs
(Contract F33615-70-C-1737; AF Proj. 3145)
(AD-757535; AFAPL-TR-72-85) Avail: NTIS CSCL 10/3

The program covers work performed on the EMBC114C Maintenance Free, Nickel-Cadmium Battery System. The EMBC114C consists of a hermetically sealed nickel-cadmium battery and an associated control logic and charger circuit. The Battery System is compatible with existing aircraft electrical systems and may be operated at altitudes up to 100,000 feet. The system is a two-terminal device connected in parallel with the aircraft 28 vdc power. This system was modified to reduce EMI and minimize bus power interruptions when switching from charge to discharge. Tests were performed to verify these modifications. A study was conducted to determine the best charge rate, whether sealed or vented cells were most suitable, and the advisability of using three terminal systems where possible. The EMBC114C is the modified system in accordance with the stated objectives and was qualification tested. GRA

N73-23018# Army Mobility Equipment Research and Development Center, Fort Belvoir, Va.
ACCEPTANCE TESTS OF 3.0-KW,60-HZ,ORGANIC, RANKINE-CYCLE POWER PLANT Final Acceptance Test, Aug. - Dec. 1971
J. Harrison Daniel, Jr. Jan. 1973 178 p refs
(AD-757632; USAMERDC-2049) Avail: NTIS CSCL 10/2

The report covers the acceptance tests performed on a 3.0-kw, advanced development, organic, Rankine-cycle power plant developed by Thermo Electron Corporation, Waltham, Massachusetts. The acceptance tests involve the evaluation of the following: electrical output, multifuel operation, fuel consumption, size, weight, inclined operation, noise level, extreme temperature operation, and life. The report includes a description of the principal components and control logic of the set and discusses the results of the tests performed. Modifications made during the test program and suggestions to improve the design are included. Author (GRA)

N73-23019# Tyco Labs., Inc., Waltham, Mass.
A STUDY OF THE DEGRADATION OF PLATINUM BLACK FUEL CELL CATHODES Final Technical Report
P. A. Malachesky, C. Leung, and H. Feng Oct. 1972 70 p refs
(Contract DAAK02-71-C-0380; DA Proj. 1T0-61102-A-34A)
(AD-757714; C-154F) Avail: NTIS CSCL 10/2

The report deals with a study of the mode of cathode electrocatalyst degradation in the H2-air phosphoric acid matrix fuel cell. The surface area changes which occur with thermal treatment of the Pt black electrocatalyst itself and as Teflon-Bonded fuel cell electrode material in air and in hot, concentrated H3 PO4 electrolyte have been determined by BET, electrochemical, and X-ray techniques. The influence of such factors as temperature, electrode potential, and electrocatalyst characteristics (particle size) has been examined. Sintering of dry Pt black in air at temperatures of 100-150C results in a loss of surface area, apparently by an agglomeration of crystallites with no real increase in average grain size. Sintering in air of dry Teflon-bonded platinum black electrode material shows less marked surface area changes as compared to surface area losses in the H3 PO4 electrolyte. Surface area losses are a function of electrode potential, with low anodic potentials leading to more marked losses. (Author Modified Abstract) GRA

N73-23020# Atomics International, Canoga Park, Calif.
BASIC RESEARCH IN THERMIONIC ENERGY CONVERSION Final Technical Summary Report, 1 Dec. 1971 - 30 Nov. 1972
Lorin K. Hansen and Charles Warner Jan. 1973 177 p refs
(Contract N00014-70-C-0196; NR Proj. 099-346)
(AD-755955) Avail: NTIS CSCL 10/2

The report presents some of the results of the past year's work in a study of thermionic converters. It is a study of the basic processes in thermionic diodes, and the application of this

basic information to the achievement of practical thermionic energy conversion. The studies presented are: Simplified thermionic converter calculations; Research converter operation; Density of ions in a double sheath trap; The W-O system; The W(100)-O-C's system. Author (GRA)

N73-23021# Tyco Labs., Inc., Waltham, Mass.
LOW TEMPERATURE ELECTROCHEMICAL SYSTEMS
Semiannual Technical Report, 1 Jul. - 31 Dec. 1972
Paul A. Malachesky and Kathleen Cahill Mar. 1973 38 p refs
(Contract DAAB07-71-C-0291)
(AD-758171; C-153-2; ECOM-0291-3; SATR-2) Avail: NTIS CSCL 10/3

Investigations into the low temperature performance of air electrodes for use in zinc-air and other metal-air battery systems have been continued in the areas of electrode structure and electrolyte modifications. The effects of such variables as Teflon content, catalyst loading, and catalyst characteristics have been examined. While variations in Teflon content and electrocatalyst loading have minimal effects, electrocatalyst characteristics and electrode preparation procedures do have appreciable effects on air electrode performance. Electrode structures have been produced which show improved performance over present air electrode types. Carbonate and zincate have deleterious effects on air electrode performance, particularly at low temperatures (-40C). The use of a CsOH electrolyte as a substitute for KOH electrolyte appears to result in better low temperature air electrode operation. Author (GRA)

04 BIOSCIENCES

Includes aerospace medicine, exobiology, radiation effects on biological systems; physiological and psychological factors. For related information see also: 05 Biotechnology.

N73-23022 Franklin Inst. Research Labs., Philadelphia, Pa.
COOPERATIVE INVESTIGATION OF THE CARIBBEAN AND ADJACENT REGIONS, CICAR. VOLUME 2: BIBLIOGRAPHY ON MARINE BIOLOGY
Rockville, Md. Natl. Oceanog. Data Center Aug. 1972 249 p refs Sponsored by Natl. Oceanog. Data Center.
Avail: Issuing Activity

An extensive compilation of literature on the marine biology of the Caribbean Sea, Gulf of Mexico, Greater and Lesser Antilles regions, and the adjacent areas of North, Central, and South America is reported. All references appear chronologically and are alphabetized by author within year. A subject matter index, an author index, and a geographic index are included. Author

N73-23023 Franklin Inst. Research Labs., Philadelphia, Pa.
COOPERATIVE INVESTIGATION OF THE CARIBBEAN AND ADJACENT REGIONS, CICAR. VOLUME 3: BIBLIOGRAPHY ON MARINE GEOLOGY AND GEOPHYSICS
Rockville, Md. Natl. Oceanog. Data Center Aug. 1972 244 p refs Sponsored by Natl. Oceanog. Data Center
Avail: Issuing Activity

An extensive compilation of literature on the marine geology and geophysics of the Caribbean Sea, Gulf of Mexico, Greater and Lesser Antilles regions, and the adjacent regions of North, Central, and South America is reported. All references appear chronologically and are alphabetized by author within a year. A subject matter index, an author index, and a geographic index are included. Author

N73-23024# Joint Publications Research Service, Arlington, Va.
SPACE BIOLOGY AND MEDICINE, NO. 2, 1973
15 May 1973 145 p refs Transl. into ENGLISH of Kosmich. Biol. i Med. (Moscow), no. 2, Mar. - Apr. 1973
(JPRS-59015) Avail: NTIS HC $9.25

Research activities reported consider the selection and training of astronauts for space flight. Emphasis is placed on the physiological effects on the human component in the man-spaceship system, and environmental simulation of these effects. For individual titles, see N73-23025 through N73-23045.

N73-23025 Joint Publications Research Service, Arlington, Va.
MICROBIOLOGICAL INVESTIGATIONS DURING SPACE-FLIGHT
A. A. Lukin and G. P. Parfenov *In its* Space Biol. and Med., No. 2, 1973 15 May 1973 p 1-15 refs (For availability see N73-23024 14-04)

A review of the Soviet and foreign literature concerning microbiological investigations in space during the period 1930 - 1970 is presented. It covers the results of experiments carried out aboard balloons, high altitude rockets and earth satellites. It is concluded that weightlessness exerts no significant effect on the growth, development, cell and nuclear division and mutagenesis of microorganisms; it produces no modifying influence on the radiation effect. A number of contradictions in experimental findings are discussed and immediate tasks of microbiological investigations on future space missions are outlined. Author

N73-23026 Joint Publications Research Service, Arlington, Va.
INVESTIGATION OF SOME BLOOD INDICES IN WHITE RATS EXPOSED TO SIXTY DAY HYPOKINESIA
P. V. Vasilyev, N. N. Uglova, A. I. Volozhin, and V. Ye. Potkin *In its* Space Biol. and Med., No. 2, 1973 15 May 1973 p 16-21 refs (For availability see N73-23024 14-04)

The effect of 5, 10, 20, 40 and 60 days of hypokinesia on circulating plasma volume, red blood cell count, hemoglobin content and hematocrit index was studied using 100 white rats. Under the influence of prolonged hypokinesia the experimental animals developed insignificant changes in the total volume of circulating plasma and blood, a distinct increase in the hematocrit, red blood cell count and hemoglobin, and weight losses. The fact that the circulating plasma volume of hypokinetic animals remained unaltered suggests that the horizontal position of animals excludes the possibility of activating the Henry-Gauer reflex as the triggering mechanism bringing about a decrease in the circulating plasma volume. Author

N73-23027 Joint Publications Research Service, Arlington, Va.
CONTENT OF PROTEIN AND NUCLEIC ACIDS IN THE TISSUES OF ANIMALS DURING HYPOKINESIA
I. V. Fedorov and I. F. Shurova *In its* Space Biol. and Med., No. 2, 1973 15 May 1973 p 22-28 refs (For availability see N73-23024 14-04)

The protein and nucleic acid content and weight of the gastrocnemius muscles were determined in rats in the organs and tissues on the 15th, 20th, 30th and 60th days. It was established that the weight of the gastrocnemius muscles decreased by almost a factor of two, the protein content in them decreased substantially and the DNA and RNA quantity increased. The content of proteins also decreased in the tissues of the liver, kidneys and heart; the DNA quantity did not change, whereas the RNA quantity either did not change or in certain periods increased. Author

N73-23028 Joint Publications Research Service, Arlington, Va.
FUNCTIONAL STATE OF THE SKELETAL MUSCLES OF RATS DURING PROLONGED RESTRICTION OF MOBILITY (UP TO 120 DAYS)
V. S. Oganov and A. N. Potapov *In its* Space Biol. and Med., No. 2, 1973 15 May 1973 p 29-36 refs (For availability see N73-23024 14-04)

In acute experiments in situ, the state of the skeletal muscles of the lower leg in an isometric regime during the course of four month hypokinesia was studied. The depressing effect of hypokinesia on the functional state of the skeletal muscles was manifested in a slowing of the time of development and decrease in strength of the soleus muscle, a decrease in the frequency of fused tetanus and the strength of individual and tetanic responses of the investigated muscles. Author

N73-23029 Joint Publications Research Service, Arlington, Va.
EFFECT OF PROLONGED HYPOKINESIA ON SOME INDICES OF ENERGY METABOLISM IN THE SKELETAL MUSCLES AND IN SOME INTERNAL ORGANS
N. P. Rassolva, A. N. Potapov, I. M. Sapelkina, and I. I. Grebennikova *In its* Space Biol. and Med., No. 2, 1973 15 May

1973 p 37-46 refs (For availability see N73-23024 14-04)

Metabolic changes in the skeletal muscles, the heart and liver of rats exposed to 120-day hypokinesia were investigated. As the exposure continued, oxidative phosphorylation decreased and anaerobic oxidation increased. This was very clear in the skeletal muscles and less distinct in the myocardium and liver. The muscles also showed morphological signs of atrophy. These changes can be attributed to the cumulative effect of hypokinesia as such and chronic stress. Author

N73-23030 Joint Publications Research Service, Arlington, Va.
CEREBELLAR REACTIONS DURING DIFFERENT REGIMES OF ROTATION OF ANIMALS ON A CENTRIFUGE
L. D. Klimovskaya and N. P. Smirnova *In its* Space Biol. and Med., No. 2, 1973 15 May 1973 p 47-54 refs (For availability see N73-23024 14-04)

The possibility of modifying cerebellar responses of rats to centripetal accelerations was studied for different rotation regimes. It is shown that: (1) the level of inhibition of the induced potential has an insignificant dependence on the rate of acceleration increment from 4 to 10 g; (2) the acceleration effect increases noticeably with the duration of rotation even at low intensities; (3) the effect of an exposure to 10 g is not associated with preexposure to accelerations of 6 and 10 g; (4) the effect of an exposure to 10 g does not depend on preliminary daily exposures to accelerations of 2 to 8 g. The experiments with the mentioned accelerations reveal neither accumulation of the acceleration effect nor cerebellar adaptation to it. Author

N73-23031 Joint Publications Research Service, Arlington, Va.
ASYMMETRY OF OTOLITHIC REACTIONS IN FISH
G. I. Samarin and B. B. Yegorov *In its* Space Biol. and Med., No. 2, 1973 15 May 1973 p 55-59 refs (For availability see N73-23024 14-04)

Experiments were carried out using nine adult pikes. Eye tonic movement in response to displacement of the statolith of the left and right utriculus is referred to as the otolith reaction. A statistically significant asymmetry of the sensitivity of otolithic receptors was established. This asymmetry of the otolithic apparatus may possibly be one of the factors causing vestibular disturbances in cosmonauts during spaceflight. Author

N73-23032 Joint Publications Research Service, Arlington, Va.
INVESTIGATION OF THE EFFECT OF INCREASED OXYGEN CONCENTRATIONS ON CHLORELLA METABOLISM
G. I. Meleshko, A. A. Antonyan, A. I. Kazakov, and Ye. K. Lebedeva *In its* Space Biol. and Med., No. 2, 1973 15 May 1973 p 60-65 refs (For availability see N73-23024 14-04)

The intensity of Chlorella photosynthesis is linearly dependent on atmospheric oxygen concentration. In the range of 5-50 percent O2 an increase in the oxygen concentration by 10 percent decreases photosynthesis intensity on the average by 15 percent of the initial level. An increase in atmospheric oxygen concentration results in an increase in the content of biogenous elements in algal cells. An increase in the nitrogen content in cells was caused by the nonprotein fraction of organic nitrogen, whereas an increase in the quantity of phosphorus in cells occurs at the expense of the acid soluble fraction of organic phosphorus. Author

N73-23033 Joint Publications Research Service, Arlington, Va.
EFFECT OF RADIOPROTECTANTS ON FUNCTIONAL STATE OF THE VESTIBULAR ANALYZER
L. N. Suslova, V. I. Yefimov, L. N. Kornilova, P. I. Kumets, and A. A. Losev *In its* Space Biol. and Med., No. 2, 1973 15 May 1973 p 66-72 refs (For availability see N73-23024 14-04)

The radioprotectants ambratine (cysteaminehydrotartrate with pyridoxine), mexamine (5-methyoxytryptamine) and vitamin-amino acid complex (amitetravite) in the tested doses produced no negative effect on the state of the vestibular analyzer and induced no decrease in vestibular stability of animals and humans. It is suggested that vestibular reactions be used in evaluating the effect of radioprotectants on the living organism. Author

N73-23034 Joint Publications Research Service, Arlington, Va.
EFFECT OF PERMANENT MAGNETIC FIELDS UP TO 4500 OE ON THE MITOTIC ACTIVITY OF CORNEAL EPITHELIAL CELLS IN MICE
G. V. Galaktionova and A. D. Strzhizhovskiy *In its* Space Biol. and Med., No. 2, 1973 15 May 1973 p 73-77 refs (For availability see N73-23024 14-04)

The biological affect of permanent magnetic fields of 1,000 and 4,500 oe on the physiological regeneration of corneal epithelial cells of mice is studied. It is shown that an exposure to these fields of 10 to 180 minutes in duration causes a reversible inhibition of mitotic activity, the level of which is related to field parameters. The exposure induces no changes in the frequency of aberrant mitoses and the number of cells in the microscope standard field of view. The exposure produces no effect on the rate of mitotic processes. Author

N73-23035 Joint Publications Research Service, Arlington, Va.
EFFECT OF PROTEIN QUALITY IN THE RATION OF RATS ON THEIR TOLERANCE OF ACUTE HYPOXIA
V. I. Fofanov, N. A. Agadzhanyan, G. I. Kozinets, and A. V. Sergiyenko *In its* Space Biol. and Med., No. 2, 1973 15 May 1973 p 78-84 refs (For availability see N73-23024 14-04)

The relationship between the quality of protein in the diet of rats and their tolerance to acute hypoxia has been studied. It was found that the lack of animal protein in the diet decreases substantially the altitude tolerance of sexually immature animals. The collected data indicate that the nutrient proteins are very important for the formation of the animal body. Author

N73-23036 Joint Publications Research Service, Arlington, Va.
DYNAMIC KATATHERMOMETER FOR MEASURING THE COOLING EFFECT OF THE ENVIRONMENT c14
L. Novak and Y. Cesnak *In its* Space Biol. and Med., No. 2, 1973 15 May 1973 p 85-90 refs (For availability see N73-23024 14-04)

The design of an electrical katathermometer for dynamic measurements of the environmental cooling effect on the human body is reported. The instrument is characterized by a temperature sensor and an autoregulation system identical with the autoregulation parameters of the compensation part. Deviation of sensor temperature from the stipulated level is measured by voltmeter and registered by a recording device. The described instrument can be used to measure changes in heat transfer by a homoiothermal system with a temperature of 37.0 plus or minus 0.1 deg; it is portable and simple to operate. G.G.

N73-23037 Joint Publications Research Service, Arlington, Va.
CHANGE IN CARDIAC ACTIVITY AND ITS PHASE STRUCTURE DURING LOWER BODY DECOMPRESSION
V. G. Voloshin and L. Ya. Divina *In its* Space Biol. and Med., No. 2, 1973 15 May 1973 p 91-97 refs (For availability see N73-23024 14-04)

The phase structure of the cardiac cycle was studied during exposure of test subjects to lower body negative pressure of -40, -50 and -80 mm Hg. The following changes were observed: an increase in the periods of isometric contraction and tension, a decrease in the ejection phase and the mechanical systole, an increase in the index of myocardial tension and the systolic index, and an increase in heart rate. The level of these changes was related to the LBNP value. Alternations in the phase structure of the cardiac cycle induced by LBNP of -50 mm Hg were similar to those seen during a tilt test. The syndrome of myocardial hypodynamics that developed thereby may result from a decreased venous return to the heart. Author

N73-23038 Joint Publications Research Service, Arlington, Va.
REACTIONS OF EYE RETINAL VESSELS AND INTRAOCULAR PRESSURE DURING MAN'S 120 DAY RESTRICTION TO A HORIZONTAL POSITION
M. P. Kuzmin *In its* Space Biol. and Med., No. 2, 1973 15 May 1973 p 98-104 refs (For availability see N73-23024 14-04)

The results of measurements of diastolic pressure in the central retinal artery, blood pressure in the brachial artery, caliber of retinal vessels and intraocular pressure in 10 healthy male test subjects during a 120 day bed rest experiment are reported. Simultaneous phasic changes in the above indices giving evidence of a shift in the tone of retinal vessels were found. At the end of the bed rest experiment and during recovery these indices were similar to the reference levels. During the experiment the intraocular pressure increased, attaining the upper normal limit. Author

N73-23039 Joint Publications Research Service, Arlington, Va.
WAYS TO INCREASE EFFECTIVENESS OF PHYSICAL TRAINING c05
V. A. Tishler, V. V. Bazhanov, N. I. Goltsman, L. S. Aleyev, S. G. Bunimovich, and B. Ya. Spichinetskiy *In its* Space Biol. and Med., No. 2, 1973 15 May 1973 p 105-112 refs (For availability see N73-23024 14-04)

The combined use of bioelectric monitoring and motion picture survey for optimal in-flight physical training of astronauts is outlined. A system for reproducing human movement is used to formulate the bioelectric monitoring program that includes participation of several muscles in the performance of a definite movement and adapts to the individual peculiarities of the human performer. It is concluded that astronaut physical training effectiveness increases substantially with use of the recorded stabilograms. G.G.

N73-23040 Joint Publications Research Service, Arlington, Va.
EFFECT OF VESTIBULAR ANALYZER IRRITATION UNDER HYPOXIC CONDITIONS ON SOME VISUAL ANALYZER FUNCTIONS c05
S. S. Markaryan, N. T. Drozdova, and I. A. Sidelnikov *In its* Space Biol. and Med., No. 2, 1973 15 May 1973 p 113-119 refs (For availability see N73-23024 14-04)

After irritation of the vestibular analyzer by the method of continuous accumulation of Coriolis accelerations (CACA), in the control and under hypoxic conditions a study was made of the dynamics of changes in the visual functions (acuity and field of view, caliber of retinal vessels). A definite dependence between changes in visual functions and the degree of vestibular stability was found: in vestibularly stable persons the visual acuity and field of view did not change; dilatation of the retinal vessels was noted. In persons with well expressed symptoms of vestibular-autonomic disorders one could observe spasm of the retinal vessels and a decrease in visual acuity and the field of view. With breathing of a hypoxic mixture the caliber of the retinal vessels increased but the visual acuity and field of view decreased. Author

N73-23041 Joint Publications Research Service, Arlington, Va.
INVESTIGATION OF CHROMOSOMAL ABERRATIONS IN LYMPHOCYTES OF HUMAN PERIPHERAL BLOOD WITH IN VITRO EXPOSURE TO 645-MeV PROTONS AND X-RAYS
N. I. Ryzhov, A. M. Totseva, R. D. Govorun, T. S. Malyutina, and V. N. Gerasimenko *In its* Space Biol. and Med., No. 2, 1973 15 May 1973 p 120-127 refs (For availability see N73-23024 14-04)

Lymphocytes of the human peripheral blood in the presynthetic phase of the mitotic cycle were irradiated in vitro by 645-MeV protons in doses of 25 to 400 rad. The tabulated data reveal no differences in the induction of chromosomal aberrations by protons and X-rays. Author

N73-23042 Joint Publications Research Service, Arlington, Va.
COMPUTATION OF THE CORIOLIS ACCELERATION ACTING ON RECEPTORS OF HUMAN SEMICIRCULAR CANALS IN ROTATING SYSTEMS
I. Yu. Sarkisov *In its* Space Biol. and Med., No. 2, 1973 15 May 1973 p 128-132 refs (For availability see N73-23024 14-04)

The general rules for determining the strength and directions of the Coriolis forces acting on the receptors of the semicircular canals in tests used for the vestibular selection and training of flight personnel and cosmonauts are studied. Author

N73-23043 Joint Publications Research Service, Arlington, Va.
EFFECT OF RESTRICTION OF MOTOR ACTIVITY OF ANIMALS ON THEIR TOLERANCE TO AN ACUTE EXPOSURE TO CARBON MONOXIDE
B. I. Abidin, V. I. Belkin, L. T. Poddubnaya, and G. D. Yukhnovskiy *In its* Space Biol. and Med., No. 2, 1973 15 May 1973 p 133-135 refs (For availability see N73-23024 14-04)

The influence of hypokinesia on the tolerance of rats in acute exposure to carbon monoxide atmospheres was studied. Experimental data indicated that hypokinesia reduced rat tolerance to carbon monoxide poisoning. G.G.

N73-23044 Joint Publications Research Service, Arlington, Va.
NEW BOOK ON THE GRAVITATIONAL RECEPTOR
In its Space Biol. and Med., No. 2, 1973 15 May 1973 p 136-138 ref (For availability see N73-23024 14-04)

As a result of the vigorous development of space technology and the increasing duration and range of flights the problem of the interaction between living organisms and the earth's gravitational field has become very timely. The reviewed monograph is devoted to one of the aspects of this problem: structural evolution of the vestibular apparatus. The book is based on experimental data; evolution of the organs sensing gravitation is traced, beginning with single-cell organisms and ranging through mammals. Author

N73-23045 Joint Publications Research Service, Arlington, Va.
FOURTH ALL-UNION CONFERENCE ON SPACE BIOLOGY AND AEROSPACE MEDICINE
M. I. Kozar *In its* Space Biol. and Med., No. 2, 1973 15 May 1973 p 139-140 Conf. held at Kaluga, USSR, 24-27 Oct. 1972 (For availability see N73-23024 14-04)

The conference on exobiology and aerospace medicine considers various problems of human exposure to space flight conditions. Special emphasis is given to the prevention of flight accidents, psychophysiological effects, life support systems, and instrumentation for conducting in-flight medical investigations. G.G.

N73-23046# Institute for Perception RVO-TNO, Soesterberg (Netherlands).
LITERATURE REVIEW OF HUMAN MACULAR ABSORPTION IN THE VISIBLE AND ITS CONSEQUENCES FOR THE CONE RECEPTOR PRIMARIES
J. J. Vos 1972 17 p refs
(IZF-1972-17) Avail: NTIS HC $3.00

All major studies on the absorption of the human macular pigment are gathered and evaluated, and compared with a weighted mean curve. A new standard density spectrum is proposed, which slightly deviates in shape from this weighted mean curve, but has significantly lower peak value. This new density spectrum is used to correct the cone system action spectra to primaries at the receptor level. Author

N73-23047# Institute for Perception RVO-TNO, Soesterberg (Netherlands).
CALCULATIONS ON THE OPTICAL MODULATION TRANSFER OF THE HUMAN EYE FOR WHITE LIGHT
A. VanMeeteren 1973 31 p refs
(A72/KL/075)
(IZF-1973-2) Avail: NTIS HC $3.75

Modulation transfer function of the dioptrics of the human eye for white light were calculated for different pupil sizes from experimental data on the aberrations. The largest aberration is the chromatic difference of focus. Since this is well known quantitatively and is subject to small individual differences the calculated modulation transfer functions are considered representative for human eyes in general. In present calculations, the funds reflection measurements of the line scattering confirm each other. Modulation transfer is worse in vision mediated by rods due to lack of the Stiles-Crawford apodization and because of more pronounced chromatic aberration in the scotopic spectral sensitivity range. In the relevant range of low spatial frequencies this difference is small however. Author

N73-23048# Medical Biological Lab. RVO-TNO, The Hague (Netherlands).
BIOLOGICAL EFFECTS OF MICROWAVE RADIATION, PART 1
H. Heering and P. M. M. VanOsch Nov. 1971 45 p refs
(MBL-1971-7-Pt-1) Avail: NTIS HC $4.25

The only biological effects of MWR that until now could be proved experimentally with certainty are purely thermal in nature: the heating and sometimes subsequent damaging of biological material due to absorption of high-intensity microwaves. Although not completely explained by theory, the mechanism of thermal effects of microwave exposure appears to be reasonably well understood. In practice the effects due to overheating can be prevented rather easily. Author

N73-23049# Institute for Perception RVO-TNO, Soesterberg (Netherlands).

VISUALLY EVOKED CORTICAL POTENTIALS TO PATTERNED STIMULI IN MONKEY AND MAN

P. Padmos, J. J. Haaijman, and H. Spekreijse 1972 24 p refs

(IZF-1972-24) Avail: NTIS HC $3.25

Scalp responses evoked by patterned visual stimuli and by changes in luminance were recorded both from human subjects and monkeys. Three models are proposed to explain the observed stimulus-response relations: (1) Luminance detection by first order summing units; (2) a center-surround antagonistic mechanism which enhances responses to spatial patterning (3) contour detection by ordered arrays of overlapping receptive fields. Implications of the three hypotheses are discussed. Experimental evidence is presented which shows that a definite contour specific response component can be observed in most human subjects. Spatial frequency selectivity by center-surround antagonism seems in most plausible explanation of results in monkey. The difference between human and monkey stimulus-response relationships are tentatively explained by differences in cortical architecture assuming origination of the spatial frequency selectivity in striate cortex and a mainly extrastriate origin of the specific contour response. Author

N73-23050# Institute for Perception RVO-TNO, Soesterberg (Netherlands).

PSYCHOPHYSICAL EXPERIMENTS ON TUNING CURVES AND TWO-TONE INHIBITION

T. Houtgast 1972 28 p refs

(IZF-1972-25) Avail: NTIS HC $3.50

Two characteristic features of the neural coding of acoustic stimuli: high frequency selectivity and an effect known as two tone inhibition were investigated by masking-like paradigms, in which a test tone is applied to study the internal representation of a stimulus (masker). In the main part of the experiments a paradigm was used in which masker and probe were presented in continuous alternation. Results on frequency selectivity and two tone inhibition obtained appeared to be in excellent agreement with primary neuron data. Additional experiments, with a number of more traditional masking paradigms, revealed that these results are typical for paradigms using a non-simultaneous probe; with a superimposed probe (direct masking) no effect of two tone inhibition could be demonstrated. Author

N73-23051# Joint Publications Research Service, Arlington, Va.

USE OF OXYGEN FOR REDUCING THE FATIGUE OF MAN IN FLIGHT

I. S. Tomarchenko 17 May 1973 9 p refs Transl. into ENGLISH from Nauch. Dokl. Vyssh. Shk., Biol. Nauka (Moscow), no. 2, 1973 p 31-34

(JPRS-59041) Avail: NTIS HC $3.00

An investigation is presented on the effect of periodic inspiration of oxygen on fatigue in man during an eight hour stay in a pressure chamber which has rarefied air and simulates an altitude of 2400 meters. Author

N73-23052*# Scientific Translation Service, Santa Barbara, Calif.

THE EFFECTS OF THE HYDROSTATIC PRESSURE OF THE WATER BATH ON THE CAPILLARY BLOOD PRESSURE AND ON THE DEHYDRATION OF THE CONNECTIVE TISSUE

H. VonDiringshofen Washington NASA May 1973 15 p refs Transl. into ENGLISH from Z. Kreislaufforsch. (Darmstadt), v 37, 1948 p 382-390

(Contract NASw-2483)

(NASA-TT-F-14894) Avail: NTIS HC $3.00 CSCL 06P

Schade's observations on water exchange between blood and connective tissue dehydration are used to study the effect of water bath hydrostatic pressure on blood pressure. It is found that increased water level in the bath shifts the fluid exchange between blood and connective tissues. Therapeutic possibilities are discussed. Author

N73-23053*# Techtran Corp., Silver Spring, Md.

MEDICAL-BIOLOGICAL PROBLEMS OF SPACEFLIGHT: AN INDEX TO THE RUSSIAN AND FOREIGN LITERATURE

Ye. A. Akhutin, Ye. I. Koltun, M. L. Shvarts, and M. E. Ekshteyn Washington NASA May 1973 501 p refs Transl. into ENGLISH of the book "Mediko-Biologicheskiye Problemy Kosmicheskikh Poletov: Ukazatel Otechestvennoy i Zarubezhnoy Literatury" Moscow, Nauka, 1972 304 p

(Contract NASw-2485)

(NASA-TT-F-14662) Avail: NTIS HC $27.25 CSCL 06S

A bibliography is presented that contains Russian and foreign scientific literature published in the period 1961-1965 concerning the entire complex of medical-biological problems related to man's conquest of space. There are 4724 entries and an author index. The following are the index sections: General problems; space flight and perpectives for conquering space; the influence of space flight factors on the organisms; psychophysiological problems; method of physiological investigations; life support systems; selection and preparation of cosmonauts; appendix: a list of technical reports listed in the index. Author

N73-23054*# Texas A&M Univ., College Station. Dept. of Plant Sciences.

CYTOLOGICAL STUDIES OF LUNAR TREATED TISSUE CULTURES Final Report

Robert S. Halliwell [1972] 53 p refs

(Contract NAS9-12671)

(NASA-CR-128914; BB32-79-217P) Avail: NTIS HC $4.75 CSCL 06A

An electron microscopic study was made of botanical materials, particularly pine tissues, treated with lunar materials collected by Apollo 12 quarantine mission. Results show unusual structural changes within several of the treated tissues. The bodies, as yet unidentified, resemble virus particles observed within infected plant cells. Although the size and shape of the structures are comparable to rod shaped virus particles such as Tobacco mosaic, the numerical distribution, affinity for stains, and intercellular location are different. Author

N73-23055# Joint Publications Research Service, Arlington, Va.

CRYOBIOLOGICAL STUDIES AND SPACE BIOLOGY PROBLEMS

L. K. Lozina-Lozinskiy 23 May 1973 28 p Transl. into ENGLISH from the book "Ocherki po Kriobiologii" Leningrad, Izd-vo Nauka, 1972 p 238-260

(JPRS-59129) Avail: NTIS HC $3.50

The adaptation and reactions of different living systems to low and ultralow temperatures of space are studied. The possibility of the existence of terrestrial organisms under conditions characteristics for the planet Mars is considered with emphasis on effects of radiation and low temperatures. It is shown that cold tolerances of living systems depend on their adaptation to environmental conditions and on the molecular structure and peculiarities of protein and other substances determining the strength of viable cell structures independently of adaptation processes. G.G.

N73-23056*# Department of Health, Education, and Welfare, Phoenix, Ariz. Environmental Microbiology Section.

SERVICES PROVIDED IN SUPPORT OF THE PLANETARY QUARANTINE REQUIREMENTS Report for Jan. - Mar. 1973

M. S. Favero Mar. 1973 11 p

(NASA Order W-13062)

(NASA-CR-132022; Rept-41) Avail: NTIS HC $3.00 CSCL 06M

The microbiological studies of the Apollo 17 command module pre- and postflight samples are reported. A total of 20 types of microorganisms were identified on preflight and 14 on postflight samples. Changes in biochemical character due to subculture and storage of Bacillus isolates are also reported. F.O.S.

N73-23057# Advisory Group for Aerospace Research and Development, Paris (France).

CURRENT STATUS IN AEROSPACE MEDICINE

Walton L. Jones, ed. (NASA, Washington, D. C.) Feb. 1973 77 p refs Presented at Aerospace Med. Panel Specialist Meeting, Glasgow, Scotland, 7-8 Sep. 1972

(AGARD-CP-110) Avail: NTIS HC $6.00

Proceedings from an aerospace medicine conference are presented, emphasizing human tolerances to various stress factors incurred during flight. The diseases, syringomyelia and hepatitis, are considered in terms of their effect on the flying fitness of

personnel. Compound breeding of Rhesus monkeys is included. For individual titles, see N73-23058 through N73-23068.

N73-23058* National Aeronautics and Space Administration, Washington, D.C.
RECENT NASA AEROSPACE MEDICINE TECHNOLOGY DEVELOPMENTS
Walton L. Jones *In* AGARD Current Status in Aerospace Med. Feb. 1973 8 p refs (For availability see N73-23057 14-04)
CSCL 06E

Areas of life science are being studied to obtain baseline data, strategies, and technology to permit life research in the space environment. The reactions of the cardiovascular system to prolonged weightlessness are also being investigated. Particle deposition in the human lung, independent respiratory support system, food technology, and remotely controlled manipulators are mentioned briefly. J.A.M.

N73-23059 Naval Aerospace Medical Research Lab., New Orleans, La.
NON-FATAL EJECTION VERTEBRAL FRACTURE AND ITS PREVENTION
Channing L. Ewing *In* AGARD Current Status in Aerospace Med. Feb. 1973 8 p refs (For availability see N73-23057 14-04)

Several studies of the nature and extent of the problem were made. Jones et al showed that 21% of 165 U.S. Navy aviators suffered vertebral fracture using a gun-type ejection seat over a 4 1/4 year period 1958-1963. (2) Of these, six were retired on disability and one additional died. Fryer found a 19% incidence in 220 R.A.F. ejection using a similar seat. (3) Hirsch found a 25% incidence in 55 Swedish Air Force ejections using a different seat. (4) More recently, Shannon found that in the U.S.A.F. during CY 1967 and 1968, there were 390 noncombat ejections with 116 persons suffering major nonfatal injury. (5) Forty-one of the major injuries were fractures due to ejection force, and 97% of these were vertebral fractures. In the combat ejections, 89% of major injuries due to ejection force were vertebral fractures, and 80% of all vertebral fractures suffered were due to ejection force. In all, 31% of noncombat and 25% of combat major injuries on ejection were nonfatal ejection vertebral fractures. In both cases the ejection vertebral fractures were the largest single category of major injury. Author

N73-23060 Hellenic Air Force General Hospital, Athens (Greece).
MANAGEMENT OF ASYMPTOMATIC CARRIERS OF HEPATITIS-ASSOCIATED-ANTIGEN (HAA) IN HELLENIC AIR FORCE PERSONNEL
H. G. Vissoulis and C. E. Giannopoulos *In* AGARD Current Status in Aerospace Med. Feb. 1973 4 p refs (For availability see N73-23057 14-04)

A large-scale investigation among Hellenic Air Force personnel was instituted in Jan. 1971 aiming at detecting the asymptomatic HAA carriers and recommending means of prevention, medical disposition and/or elimination from flying and certain specialties. This systematic screening is justified by a high correlation of positive HAA and cases of acute viral hepatitis. A disquieting incidence of 5.2% of asymptomatic HAA carriers was demonstrated. Author

N73-23061 Institute of Aviation Medicine, Fuerstenfeldbruck (West Germany).
SYRINGOMYELIA AND FLYING FITNESS
Guenter Apel *In* AGARD Current Status in Aerospace Med. Feb. 1973 3 p refs (For availability see N73-23057 14-04)

The extent to which the existing syringomyelia had contribution to fatal accidents and the question of specific flying conditions being conducive to an exacerbation of syringomyelia are discussed. Histological examinations of organs of pilots involved in fatal accidents have often revealed diseases, in particular those involving the heart, which may have limited flying fitness. Author

N73-23062 Johann-Wolfgang-Goethe-Universitat, Frankfurt am Main (West Germany). Arbeitsgruppe fuer Biophysikalische Weltraumforschung.
THE BIOSTACK EXPERIMENT ON APOLLO 16
H. Buecker *In* AGARD Current Status in Aerospace Med. Feb. 1973 6 p refs (For availability see N73-23057 14-04)

The objective of the BIOSTACK experiment, flown onboard Apollo 16, is to study the combined action of individual heavy high energy loss nuclei of cosmic radiation and space flight factors on biological systems in resting state. The results will give information on the mechanism of heavy particles on biological matter. The BIOSTACK experimental package contains a series of monolayers of selected biological objects (Bacillus subtilis spores, Arabidopsis thaliana seeds, Vicia faba radiculae, Artemia salina eggs) with each layer sandwiched between several different physical track detectors (nuclear emulsions, cellulose nitrate, polycarbonate). Individual local evaluation methods were developed which identify each biological effective particle and correlate the individual hitting particle with the produced biological effect. A variety of biological effects due to a single penetrating particle is being analyzed: influence on cellular and tissue development, nuclear damages, and mutation induction. Author

N73-23063* Flugwissenschaftliche Forschungsanstalt, Munich (West Germany). Yerkes Primate Research Center.
BREEDING MONKEYS FOR BIOMEDICAL RESEARCH
Geoffrey H. Bourne, M. Nelly GolarzdeBourne, and Michale E. Keeling *In* AGARD Current Status in Aerospace Med. Feb. 1973 6 p refs (For availability see N73-23057 14-04)
(NASA Order R-10-009-013; Grant RR-00165)
CSCL 06C

Captive bred rhesus monkeys show much less pathology than wild born animals. The monkeys may be bred in cages or in an outdoor compound. Cage bred animals are not psychologically normal which makes then unsuited for some types of space related research. Compound breeding provides contact between mother and infant and an opportunity for the infants to play with their peers which are important requirements to help maintain their behavioral integrity. Offspring harvested after a year in the compound appear behaviorally normal and show little histopathology. Compound breeding is also an economical method for the rapid production of young animals. The colony can double its size about every two and a half years. Author

N73-23064 Royal Air Force Inst. of Aviation Medicine, Farnborough (England).
HYBRID COMPUTING: A TECHNIQUE FOR THE IMMEDIATE ANALYSIS OF PHYSIOLOGICAL DATA c08
G. H. Byford *In* AGARD Current Status in Aerospace Med. Feb. 1973 4 p refs (For availability see N73-23057 14-04)

The solution must include a means for rejecting that part of the data considered to be of little importance; a technique for establishing the probable difference between two possibly similar recordings, or the probable similarity between two apparently different recordings; and the speedy processing of data, preferably but not necessarily carried out during the experiment. Much can be done with simple and easily understood statistics, a small hybrid computer, and the allocation of a little thought to the problem as a whole rather than to its isolated parts. These processes are illustrated by considering the real-time analysis of a multichannel electrophysiological recording, using uncomplicated mathematics and the parallel-serial hybrid computing installation. Author

N73-23065 School of Aerospace Medicine, Brooks AFB, Tex. Applied Physiology Branch.
AEROMEDICAL EVALUATION OF THE PHASED-DILUTION CONCEPT FOR OXYGEN BREATHING SYSTEMS c05
Robert W. Krutz, Jr., William J. Sears, Kenneth G. Gould, Jr., and Richard W. Bancroft *In* AGARD Current Status in Aerospace Med. Feb. 1973 7 p refs (For availability see N73-23057 14-04)

This series of studies was designed to compare the relative effectiveness of phased-dilution with current demand-diluter oxygen delivery systems in artificially ventilated dogs and in seated, quietly breathing humans. The arterial oxygen tension approximately doubled in the canine model with the phased-dilution oxygen delivery when compared with comparable quantities of premixed oxygen at ground level and at simulated altitudes of 10,000 and 18,000 feet in a decompression chamber. Arterial oxygen tensions in humans breathing in a random fashion were higher with the phased-dilution oxygen delivery system than with comparable quantities of premixed oxygen. Human arterial oxygen

tensions measured with the phased-dilution technique at ground level and in a chamber at subatmospheric pressures equivalent to altitudes of 10,000 and 18,000 feet were less than predicted from the canine work. It appears that this more limited effectiveness is closely related to a respiratory dead space effect and is influenced by frequency and depth of breathing with a fixed bolus. Author

N73-23066 Naval Aerospace Medical Research Lab., New Orleans, La.

SPECIALIZED ANTHROPOMETRY REQUIREMENTS FOR PROTECTIVE-EQUIPMENT EVALUATION c05

Daniel J. Thomas *In* AGARD Current Status in Aerospace Med. Feb. 1973 8 p refs (For availability see N73-23057 14-04)

Anthropometry was considered from the point of view of its application to problems of protective-equipment evaluation, human impact-acceleration experiments, and flying personnel populations. The difficulties of supplying data for all three areas of endeavor are discussed. A three-dimensional anatomically referenced basis for recording anthropometric data is offered as an adequate approach. Coordinate systems for the head and the first thoracic vertebral body are described. Author

N73-23067 Office of the Air Force Surgeon General, Washington, D.C.

HUMAN EXPOSURE CRITERIA TO LASER ENERGY

Donald I. Carter, William E. Mabson, and James F. Culver *In* AGARD Current Status in Aerospace Med. Feb. 1973 5 p ref (For availability see N73-23057 14-04)

The United States Air Force is adapting laser technology to many combat and combat support uses. Some of these uses include distance measuring to assist in aiming airborne guns in the AC-130 gunships, boresighting guns on fighter aircraft, and target marking for accurate aerial bombing. The number of different lasers and their uses are increasing. Since these high energy monochromatic light beams can produce biological damage, safe exposure criteria are needed to assist in developing safe exposure distances, protective devices, and medical surveillance programs. Author

N73-23068 Centro di Studi e Ricerche di Medicina Aeronautica e Spaziale, Rome (Italy).

STUDY ON SOME AIR FORCE OPERATIONAL ACTIVITIES IN ITALY, WITH REFERENCE TO THERMAL CONDITIONS AND THEIR EFFECTS ON ACCELERATION TOLERANCE AND PSYCHOMOTOR PERFORMANCE

Paolo Rota *In* AGARD Current Status in Aerospace Med. Feb. 1973 10 p refs (For availability see N73-23057 14-04)

Climate in Italy, in summer period, presents such characteristics that, in Air Force operational activities, performance of AF personnel can be affected. Because of this, a series of researches was carried out, in this field. After a brief survey on main features of Italian climate, and summer climatic conditions in some AF bases, the results are reported on microclimatic data recorded in the interior of the cockpit and inside motor vehicles cabins, while parking in summer daylight period. Physiological importance of these data, and the effects on working efficiency are discussed and evaluated by means of some heat stress indexes. Results of experimental parallel researches are also reported to assess the effects on acceleration tolerance and psychomotor performance, of situations simulating scramble take off. Author

N73-23069*# Wake Forest Univ., Winston-Salem, N.C. Bowman Gray School of Medicine.

FUNCTIONAL PRESERVATION OF VASCULAR SMOOTH MUSCLE TISSUE Final Report, 1 May 1971 - 31 Mar. 1973

W. C. Alexander, P. M. Hutchins, and S. L. Kimzey 30 Mar. 1973 16 p Submitted for publication

(Contract NAS9-11690)

(NASA-CR-128897) Avail: NTIS HC $3.00 CSCL 06P

The ionic and cellular feedback relationships operating to effect the vascular decompensatory modifications were examined to reveal procedures for implementing protective measures guarding against vascular collapse when returning from a weightless environment to that of the earth's gravity. The surgical procedures for preparing the rat cremaster, and the fixation methods are described. Abstracts of publications resulting from this research are included. F.O.S.

N73-23070*# Battelle-Northwest, Richland, Wash.

THE MEASUREMENT OF RADIATION EXPOSURE OF ASTRONAUTS BY RADIOCHEMICAL TECHNIQUES Quarterly Research Report, 3 Apr. - 2 Jul. 1972

R. L. Brodzinski 15 Jul. 1972 22 p refs Sponsored in part by NASA

(Contract AT(45-1)-1830)

(NASA-CR-131984; BNWL-1183-12) Avail: NTIS HC $3.25 CSCL 06R

Cosmic radiation doses to the crews of the Apollo 14, 15, and 16 missions of 142 + or - 80, 340 + or - 80, and 210 + or - 130 mR respectively were calculated from the specific activities of Na-22 and Na-24 in the postflight urine specimens of the astronauts. The specific activity of Fe-59 was higher in the urine than in the feces of the Apollo 14 and 15 astronauts, and a possible explanation is given. The concentrations of K-40, K-42, Cr-51, Co-60, and Cs-137 in the urine are also reported for these astronauts. The radiation doses received by pilots and navigators flying high altitude missions during the solar flare of March 27 to 30, 1972 were calculated from the specific activity of Na-24 in their urine. These values are compared with the expected radiation dose calculated from the known shape and intensity of the proton spectrum and demonstrate the magnitude of atmospheric shielding. The concentrations of Na, K, Rb, Cs, Fe, Co, Ag, Zn, Hg, As, Sb, Se, and Br were measured in the urine specimens from the Apollo 14 and 15 astronauts by neutron activation analysis. The mercury and arsenic levels were much higher than expected. Author (NSA)

N73-23071# Naval Aerospace Medical Inst., Pensacola, Fla.

A LIMITED REVIEW OF THE EFFECT OF CIGARETTE SMOKING ON PERFORMANCE WITH EMPHASIS ON AVIATION

Richard S. Gibson and William F. Moroney 22 Nov. 1972 14 p refs

(AD-754421; NAMI-SR-72-2) Avail: NTIS CSCL 05/10

Increased knowledge concerning the detrimental effects of smoking has created a desire to identify any adverse effects that smoking might have on aircrew performance. A limited review of the literature was undertaken to provide some perspective on the likely effects of smoking on variables related to aircrew performance. The authors concluded that cigarettes do significantly affect various sensory thresholds, but that the significance of these effects appears to be of little practical importance. They also noted that withdrawal does produce significant performance decrements. Author (GRA)

N73-23072# School of Aerospace Medicine, Brooks AFB, Tex.

RED BLOOD CELL DENSITY AND VOLUME CHANGES IN MAN EXPOSED TO HYPOBARIC HYPEROXIA Interim Report, 1 Jul. 1970 - 15 Dec. 1971

William T. Williams and Edward C. Larkin Dec. 1972 15 p refs

(AF Proj. 7930)

(AD-755783; SAM-TR-72-34) Avail: NTIS CSCL 06/19

Eight volunteers were exposed to 100% O2 at 258 mm Hg for 31 days. Blood samples were taken daily, and red cell (RBC) volume distributions were determined by Coulter counter--RBC density distributions, by the method of Danon and Marikovsky. RBC volume distribution varied in a cyclic fashion but exhibited no consistent, significant changes. After 4 to 6 days in the test environment, the RBC populations showed an increase in the proportion of dense cells; and a trend of increasing senescence was evident for the remainder of the exposure period. Postexposure changes indicated the formation of new red cells. Author (GRA)

N73-23073# University of Southern Calif., Los Angeles. Dept. of Medicine.

PHYSIOLOGICAL ADAPTATIONS TO CARBON MONOXIDE LEVELS AND EXERCISE IN NORMAL MEN

C. R. Collier, J. M. Workman, J. G. Mohler, J. Aaronson, and O. Cabula Jul. 1972 23 p refs

(Contract EPA-68-02-0334)

(PB-213834/1; EPA-RI-72-002) Avail: NTIS HC $3.00 CSCL 06P

Normal, young, non-smoking men were studied at rest and during submaximal exercise with carboxyhemoglobin (COHb) levels of about 1% and after breathing CO to raise the COHb level to 8 to 9%. Arterial and mixed venous blood was sampled. The CO caused an increase in minute volume and breathing frequency during exercise but not at rest. However, CO caused no changes in cardiac output, heart rate, lactate, lactate/pyruvate ratio, tidal volume, CO2 output or 2,3 DPG during rest or exercise. The CO caused a decrease in O2 consumption, in arterial-venous O2 content difference and in venous O2 content and venous Po2 during exercise and in the latter two also at rest. Changes in O2 affinity are still being calculated. (GRA)

N73-23074# National Center for Atmospheric Research, Boulder, Colo.
CLIMATE CHANGE AND THE INFLUENCE OF MAN'S ACTIVITIES ON THE GLOBAL ENVIRONMENT
William W. Kellogg Sep. 1972 31 p Presented at Symp. on Energy, Resources and the Environment, Kyoto, 11 Jul. 1972; sponsored in part by Mitre Corp., McLean, Va.
(PB-213676/2; MITRE-72-166; M72-166) Avail: NTIS HC $3.75 CSCL 04B

The history of changes in the earth's climate are traced from the earliest times to the present as recorded in the rocks and ice caps. Man's potential impact on the climate is discussed including the impact of carbon dioxide, particulate matters, albedo changes, irrigation, and the direct release of heat. Preliminary computer calculations indicate that man can influence the climate of the earth and that the direction of this influence in the decade to come must be that of a warming essentially in the Northern Hemisphere. The Arctic Ocean pack ice represents an unstable part of the ocean-atmosphere system in that a warming that would remove the pack ice would produce a major one-way transition. The impacts of such a transition would be very grave for some regions of the earth, but cannot be spelled out to become a disaster for mankind. Author (GRA)

N73-23075# Colorado Univ., Denver. Medical Center.
TIME COURSE OF RESPIRATORY ADAPTATION TO HIGH ALTITUDE Final Report, 1 Jul. 1967 - 30 Sep. 1968
Robert F. Grover, Jerome A. Dempsey, Hubert V. Forster, Marvin L. Birnbaum, William G. Reddan, J. S. Thoden, and J. Rankin Dec. 1972 13 p refs
(Contract DADA17-68-C-8013)
(AD-755192) Avail: NTIS CSCL 06/19

The investigation was undertaken to examine cardiopulmonary adaptations of man to moderately high altitude. Emphasis was placed upon defining the time course of adaptation by examining groups of individuals exposed to chronic hypoxia for periods ranging from 4 days to 31 years. During the first weeks of exposure to high altitude, adaptations in respiratory control are not adequately explained by the popular concepts of hypoxic stimulation of peripheral chemoreceptors, with the resultant hyperventilation causing respiratory alkalosis and a reduction in hydrogen ion concentration of the cerebrospinal fluid (CSF) which is subsequently restored. Rather, exercise plus hypoxia enhance to sensitivity of the peripheral chemoreceptors, while changes in the pH of CSF are minimal and of little significance. With years of exposure to chronic hypoxia, there is a progressive diminution in the ventilatory response to hypoxic stimulation of the peripheral chemoreceptors. Consequently, the minimal ventilatory response to acute hypoxia seen in men native to high altitude is a trait acquired from many years of exposure to chronic hypoxia, rather than being dependent upon exposure to hypoxia continuously from the time of birth. Author (GRA)

N73-23971* Jet Propulsion Lab., Calif. Inst. of Tech., Pasadena.
LIPID ABSORBING POLYMERS
H. E. Marsh, Jr. and C. J. Wallace *In its* Quart. Tech. Rev., Vol. 2, No. 4 Jan. 1973 p 1-6 refs (For availability see N73-23970 14-34)
CSCL 06E

N73-23972* Jet Propulsion Lab., Calif. Inst. of Tech., Pasadena.
UNIFIED APPROACH TO THE BIOMECHANICS OF DENTAL IMPLANTOLOGY
D. E. Grenoble (Univ. of Southern Calif.) and A. C. Knoell *In its* Quart. Tech. Rev., Vol. 2, No. 4 Jan. 1973 p 7-17 refs (For availability see N73-23970 14-34)
CSCL 06B

05 BIOTECHNOLOGY

Includes life support systems, human engineering; protective clothing and equipment; crew training and evaluation, and piloting. For related information see also: 04 Biosciences.

N73-23076# Institute for Perception RVO-TNO, Soesterberg (Netherlands).
ARE SUBJECTIVE PROBABILITIES PROBABILITIES?
G. DeZeeuw and W. A. Wagenaar 1973 35 p refs
(IZF-1973-3) Avail: NTIS HC $3.75

The determination of subjective probability as degree of felt certainty is considered. A detailed analysis is given of the problem of changes in feelings of uncertainty, defined as revisions of opinion. It appears that people seem to program their behavior on the basis of rules derived from computational structures. Such structures provide actions optimal and rational in most familiar situations, are apparently easy to handle, but are not necessarily probabilistic in nature, even where uncertainty prevails. Author

N73-23077# Institute for Perception RVO-TNO, Soesterberg (Netherlands).
PACED AND SELFPACED WORK IN CONTINUOUS REACTION TIME TASKS
W. A. Wagenaar and H. Stakenburg 1973 12 p refs
(IZF-1973-5) Avail: NTIS HC $3.00

In the present experiment RT's were corrected for error rate by relating them to the speed accuracy tradeoff function, which was measured in each experimental session. In this way deciles of the RT distributions of paced and selfpaced conditions were compared, for eight subjects and four successive sessions. The task was a four choice continuous RT task, employing visual stimuli. The results show that RT distributions are wider in the paced conditions. RT's of the first deciles are faster for pacing whereas medians in paced and selfpaced conditions are about equal. The effect of pacing is independant of pacing rate, which suggests that change of RT distribution is not caused by time stress but rather by the paced task structure. Author

N73-23078# Institute for Perception RVO-TNO, Soesterberg (Netherlands).
MUSICAL INTERVAL RECOGNITION WITH SIMULTANEOUS TONES
R. Plomp, W. A. Wagenaar, and A. M. Mimpen 1972 27 p refs
(IZF-1972-20) Avail: NTIS HC $3.50

The perceptual singularity of musical intervals consisting of two simultaneous tones with a simple frequency was studied. Musically sophisticated subjects were presented with the 12 intervals between minor second and octave (within the octave 261.7-523.3 Hz; presentation durations 120, 60, 30, and 15 msec, respectively) and were required to identify which interval had been presented. The experimental results showed clearly, both for simple tone and complex tone intervals, that the subjects confused the intervals in terms of their width rather than their frequency ratio simplicity. These results confirm the view that, for simple tones, tonal consonance is related to interval width. Author

N73-23079*# National Aeronautics and Space Administration. Lewis Research Center, Cleveland, Ohio.
OPHTHALMIC METHOD AND APPARATUS Patent Application
John C. Evvard, Donald J. Vargo, and William J. McGannon, inventors (to NASA) Filed 15 Nov. 1971 10 p
(NASA-Case-LEW-11669-1; US-Patent-Appl-SN-198885) Avail: NTIS HC $3.00 CSCL 06L

A method and apparatus for removing material and components such as the lens from an eye are described. High speed rotary cutting members at one end of a rod macerate the lens while an annular tubing disposed around the cutting members vibrates ultrasonically to coact with the cutting members in

macerating the lens. At the same time, a liquid is supplied to the chamber behind the cornea of the eye. Spiral grooves extending along the rotating rod from the cutting members evacuate the liquid and the macerated material from the eye. An alternate design of the apparatus includes a tube through which liquid is supplied to the operative site of the ultrasonically vibrating tube and the cutting members in the area of the lens. NASA

N73-23080*# Technology, Inc., Houston, Tex. Life Sciences Div.
SKYLAB FOOD TEST AND INTEGRATION Final Report, 1 May 1971 - 31 Jan. 1973
Charles T. Bourland 31 Jan. 1973 216 p refs
(Contract NAS9-11843)
(NASA-CR-128910) Avail: NTIS HC $13.00 CSCL 06H

The foods and menus developed for the individual astronauts scheduled to participate in Skylab missions are listed. A.L.

N73-23081*# URS/Matrix Co., Houston, Tex. Life and Environmental Sciences Div.
APPLICATION OF EVA GUIDELINES AND DESIGN CRITERIA. VOLUME 1: EVA SELECTION/SYSTEMS DESIGN CONSIDERATIONS Final Report
Nelson E. Brown Apr. 1973 295 p refs 3 Vol.
(Contract NAS9-12997)
(NASA-CR-128926) Avail: NTIS HC $16.75 CSCL 05E

Parameters that require consideration by the planners and designers when planning for man to perform functions outside the vehicle are presented in terms of the impact the extravehicular crewmen and major EV equipment items have on the mission, vehicle, and payload. Summary data on man's performance capabilities in the weightless space environment are also provided. The performance data are based on orbital and transearth EVA from previous space flight programs and earthbound simulations, such as water immersion and zero-g aircraft. Author

N73-23082*# URS/Matrix Co., Houston, Tex. Life and Environmental Sciences Div.
APPLICATION OF EVA GUIDELINES AND DESIGN CRITERIA. VOLUME 2: EVA WORKSTATION CONCEPTUAL DESIGNS Final Report
Nelson E. Brown Apr. 1973 88 p refs 3 Vol.
(Contract NAS9-12997)
(NASA-CR-128927) Avail: NTIS HC $6.50 CSCL 05E

Several EV workstation concepts were developed and are documented. The workstation concepts were developed following a comprehensive analysis of potential EV missions, functions, and tasks as interpreted from NASA and contractor space shuttle and space station studies, mission models, and related reports. The design of a versatile, portable EVA workstation is aimed at reducing the design and development costs for each mission and aiding in the development of on-orbit serviceable payloads. Author

N73-23083*# URS/Matrix Co., Houston, Tex. Life and Environmental Sciences Div.
APPLICATIONS OF EVA GUIDELINES AND DESIGN CRITERIA. VOLUME 3: EVA SYSTEMS COST MODEL FORMATING Final Report
Nelson E. Brown Apr. 1973 75 p refs 3 Vol.
(Contract NAS9-12997)
(NASA-CR-128928) Avail: NTIS HC $5.75 CSCL 05E

The development of a model for estimating the impact of manned EVA costs on future payloads is discussed. Basic information on the EV crewman requirements, equipment, physical and operational characteristics, and vehicle interfaces is provided. The cost model is being designed to allow system designers to quantify the impact of EVA on vehicle and payload systems. Author

N73-23084*# Martin Marietta Corp., Denver, Colo.
REGENERATIVE PARTICULATE FILTER DEVELOPMENT Final Report
Victor A. DesCamp, Michael W. Boex, Michael W. Hussey, and Thomas P. Larson May 1972 136 p refs
(Contract NAS9-11984)
(NASA-CR-115505; MCR-72-40) Avail: NTIS HC $9.00 CSCL 13K

Development, design, and fabrication of a prototype filter regeneration unit for regenerating clean fluid particle filter elements by using a backflush/jet impingement technique are reported. Development tests were also conducted on a vortex particle separator designed for use in zero gravity environment. A maintainable filter was designed, fabricated and tested that allows filter element replacement without any leakage or spillage of system fluid. Also described are spacecraft fluid system design and filter maintenance techniques with respect to inflight maintenance for the space shuttle and space station. Author

N73-23085*# Massachusetts Inst. of Tech., Cambridge. Dept. of Nutrition and Food Science.
MECHANISMS OF DETERIORATION OF NUTRIENTS PHASE 1 Annual Report
Marcus Karel and James M. Flink [1972] 159 p refs
(Contract NAS9-12485)
(NASA-CR-128915) Avail: NTIS HC $10.00 CSCL 06H

Experimental methods are studied by which freeze-dried foods of improved quality are produced. Considered are: (1) Factors effecting the loss of butanol from frozen aqueous food solutions during storage; (2) a freeze-drying microscope system for observing solidification processes in organic mixtures and aqueous inorganic salt solutions; (3) browning of high quality freeze-dried foods with minimal organoleptic and nutritional detoriation; (4) retention of PVP-n-propanol in freeze-dried food models; and (5) effects of freezing rate and sucrose immersion on taste and texture of freeze-dried apple slices. G.G.

N73-23086*# Boeing Co., Seattle, Wash.
DEGRADATION OF LEARNED SKILLS: EFFECTIVENESS OF PRACTICE METHODS ON VISUAL APPROACH AND LANDING SKILL RETENTION Technical Report, Jul. 1971 - Aug. 1972
Thomas E. Sitterley, Lawrence P. Zaitzeff, and Wayne A. Berge Oct. 1972 99 p refs
(Contract NAS9-10962)
(NASA-CR-128912; D180-15082-1) Avail: NTIS HC $7.00 CSCL 05E

Flight control and procedural task skill degradation, and the effectiveness of retraining methods were evaluated for a simulated space vehicle approach and landing under instrument and visual flight conditions. Fifteen experienced pilots were trained and then tested after 4 months either without the benefits of practice or with static rehearsal, dynamic rehearsal or with dynamic warmup practice. Performance on both the flight control and procedure tasks degraded significantly after 4 months. The rehearsal methods effectively countered procedure task skill degradation, while dynamic rehearsal or a combination of static rehearsal and dynamic warmup practice was required for the flight control tasks. The quality of the retraining methods appeared to be primarily dependent on the efficiency of visual cue reinforcement. Author

N73-23087# Naval Aerospace Medical Research Lab., Pensacola, Fla.
TOWARD THE DEVELOPMENT OF A CRITERION FOR FLEET EFFECTIVENESS IN THE F-4 FIGHTER COMMUNITY
Richard H. Shannon and Wayne L. Waag 5 Dec. 1972 13 p refs
(MF51524002)
(AD-755184; NAMRL-1173) Avail: NTIS CSCL 05/9

A recurring problem in naval aviation has been the lack of adequate criteria for pilot performance in fleet-type aircraft. In a previous investigation, an attempt was made to isolate the most critical skills and procedures within each of the stages comprising East Coast replacement air group (RAG) training in the F-4 aircraft. The present investigation attempted to replicate these findings from the East Coast RAG with data obtained from the West Coast RAG squadron. For each of the stages analyzed in the East Coast RAG squadron, a small set of graded items was selected on the basis that they could adequately discriminate among replacement pilots according to their final RAG grade. The resulting set of items was found to be highly predictive of both the stage grade from which they were obtained and the final RAG grade. Data were obtained from the West

Coast RAG squadron in an attempt to replicate these findings.
Author (GRA)

N73-23088# Ohio State Univ., Columbus. Dept. of Psychology.
MULTI-TASK TIME-SHARING REQUIREMENTS Final Report, Jun. 1969 - Jul. 1971
George E. Briggs, Ronald P. Fisher, Seth N. Greenberg, James J. Lyons, Gregory L. Peters, and David Shinar Wright-Patterson AFB, Ohio AMRL Aug. 1972 40 p refs
(Contract F33615-69-C-1663; AF Proj. 7183)
(AD-755363; AMRL-TR-71-105) Avail: NTIS CSCL 05/10

Ten laboratory experiments are reported on dual-task performance. A continuous tracking task and a discrete choice reaction time task were used as representative of the kinds of information processing required of an aircraft pilot. The research dealt with three major concerns: a demonstration of the time-sharing effect, an examination of the influence of auditory noise on time-sharing localizing the time-sharing effect in an input, an output or in a central stage of human information processing, and the influence of variations in the tracking task, variations in augmented feedback across tasks, and the influence of auditory noise on dual-task performance. GRA

N73-23089# Naval Postgraduate School, Monterey, Calif.
EFFECTS OF NEUROMUSCULAR TENSION IN THE USE OF AN ISOMETRIC HAND CONTROLLER M.S. Thesis
William Steele Smith, Jr. Dec. 1972 51 p refs
(AD-757252) Avail: NTIS CSCL 05/5

The effects of operator workload on average grip pressure and of neuromuscular tension on tracking performance were the objects of this research. In one experiment, a sub-critical tracking task was performed by the operator while measurements of grip pressure were taken. In a second experiment, the operator was required to maintain average grip pressure at specified levels during 100-second tracking tasks while his RMS tracking error was measured. The results clearly indicate that average grip pressure increases as the workload increases and that higher average grip pressures result in higher RMS tracking error values. Author (GRA)

N73-23090# Instrument Flight Center, Randolph AFB, Tex.
ATC ANGLE OF ATTACK TRAINING Final Report, 3 Sep. 1971 - 18 Jul. 1972
Max L. Odle Jul. 1972 92 p refs
(AD-757243; IFC-TR-72-3) Avail: NTIS CSCL 05/9

An evaluation and study was conducted of the Bendix Standardized Angle of Attack (AOA) System for its use in Air Training Command flying training programs. The Bendix AOA System was installed in T-38, S/N 70-1549 for engineering flight test. The aircraft was then flown to Randolph AFB for pilot factors evaluation and determination of exactly what flying maneuvers could be flown using AOA as the controlling parameter and how AOA should be used in these maneuvers. Subjective data on the procedures and techniques for AOA use were gathered from twelve T-38 instructor pilots from the Pilot Instructor Training (PIT) and Instrument Pilot Instructor School (IPIS) at Randolph AFB. The conclusions from the study are given. (Author Modified Abstract) GRA

N73-23039 Joint Publications Research Service, Arlington, Va.
WAYS TO INCREASE EFFECTIVENESS OF PHYSICAL TRAINING
V. A. Tishler, V. V. Bazhanov, N. I. Goltsman, L. S. Aleyev, S. G. Bunimovich, and B. Ya. Spichinetskiy *In its* Space Biol. and Med., No. 2, 1973 15 May 1973 p 105-112 refs (For availability see N73-23024 14-04)

N73-23040 Joint Publications Research Service, Arlington, Va.
EFFECT OF VESTIBULAR ANALYZER IRRITATION UNDER HYPOXIC CONDITIONS ON SOME VISUAL ANALYZER FUNCTIONS
S. S. Markaryan, N. T. Drozdova, and I. A. Sidelnikov *In its* Space Biol. and Med., No. 2, 1973 15 May 1973 p 113-119 refs (For availability see N73-23024 14-04)

N73-23065 School of Aerospace Medicine, Brooks AFB, Tex. Applied Physiology Branch.
AEROMEDICAL EVALUATION OF THE PHASED-DILUTION CONCEPT FOR OXYGEN BREATHING SYSTEMS
Robert W. Krutz, Jr., William J. Sears, Kenneth G. Gould, Jr., and Richard W. Bancroft *In* AGARD Current Status in Aerospace Med. Feb. 1973 7 p refs (For availability see N73-23057 14-04)

N73-23066 Naval Aerospace Medical Research Lab., New Orleans, La.
SPECIALIZED ANTHROPOMETRY REQUIREMENTS FOR PROTECTIVE-EQUIPMENT EVALUATION
Daniel J. Thomas *In* AGARD Current Status in Aerospace Med. Feb. 1973 8 p refs (For availability see N73-23057 14-04)

N73-23897 Systems Control, Inc., Palo Alto, Calif.
CURRENT STATUS OF MODELS FOR THE HUMAN OPERATOR AS A CONTROLLER AND DECISION MAKER IN MANNED AEROSPACE SYSTEMS
A. V. Phatak and D. L. Kleinman *In* AGARD Automation in Manned Aerospace Systems Mar. 1973 10 p refs (For availability see N73-23881 14-31)

N73-23899 Aerospace Medical Research Labs., Wright-Patterson AFB, Ohio.
MONTE CARLO SIMULATION OF DEGRADED MAN-MACHINE PERFORMANCE
Gerald P. Chubb *In* AGARD Automation in Manned Aerospace Systems Mar. 1973 11 p refs (For availability see N73-23881 14-31)

N73-23901 Hawker Siddeley Aviation, Ltd., Hatfield (England).
HUMAN FACTORS IN LOW WEATHER OPERATION OF TRANSPORT AIRCRAFT
J. W. Wilson *In* AGARD Automation in Manned Aerospace Systems Mar. 1973 5 p (For availability see N73-23881 14-31)

N73-23904* National Aeronautics and Space Administration, Washington, D.C.
POTENTIAL TELEOPERATOR APPLICATIONS IN MANNED AEROSPACE SYSTEMS
Edwin G. Johnsen *In* AGARD Automation in Manned Aerospace Systems Mar. 1973 4 p refs (For availability see N73-23881 14-31)
CSCL 05H

N73-23905 Boeing Co., Seattle, Wash.
MAN-MACHINE CONSIDERATIONS IN THE DEVELOPMENT OF A COCKPIT FOR AN ADVANCED TACTICAL FIGHTER
S. Joel Premselaar and D. E. Frearson (AFFDL) *In* AGARD Automation in Manned Aerospace Systems Mar. 1973 20 p (For availability see N73-23881 14-31)

N73-23980* Jet Propulsion Lab., Calif. Inst. of Tech., Pasadena.
THE MESA ARIZONA PUPIL TRACKING SYSTEM
D. L. Wright *In its* Quart. Tech. Rev., Vol. 2, No. 4 Jan. 1973 p 87-92 (For availability see N73-23970 14-34)
CSCL 05E

N73-23986 Texas Technological Univ., Lubbock.
WORK-REST SCHEDULES UNDER PROLONGED VIBRATION WITH IMPLICATIONS TO MILITARY OPERATIONS
R. A. Dudek, M. M. Ayoub, M. A. El-Nawawi, and T. M. Khalil *In* Human Eng. Labs. Mil. Requirements for Res. on Continuous Operations Apr. 1972 p 51-69 refs (For availability see N73-23981 14-34)
(Contract DAAD05-69-C-0102)

N73-23987 Texas Technological Univ., Lubbock.
SELF DETERMINED WORK-REST CYCLES IN THE HEAT
J. D. Ramsey, C. G. Halcomb, and A. K. Mortagy *In* Human Eng. Labs. Mil. Requirements for Res. on Continuous Operations Apr. 1972 p 70-88 refs (For availability see N73-23981 14-34)
(Contract DAAD05-69-C-0102)

N73-23714 Royal Air Force Inst. of Aviation Medicine, Farnborough (England).
HUMAN FACTORS PROBLEMS IN CONFLICT DETECTION AND RESOLUTION
V. D. Hopkin IN AGARD Air Traffic Control Systems Apr. 1973 6 p ref (For availability see N73-23689 14-21)

N73-23988 Louisville Univ., Ky. Performance Research Lab.
APPLICABILITY OF RESEARCH ON SUSTAINED PERFORMANCE, ENDURANCE, AND WORK-REST SCHEDULING TO THE DEVELOPMENT OF CONCEPTS AND DOCTRINE OF CONTINUOUS OPERATIONS
Ben B. Morgan, Jr. and Earl A. Alluisi *In* Human Eng. Labs. Mil. Requirements for Res. on Continuous Operations Apr. 1972 p 89-115 refs (For availability see N73-23981 14-34)

N73-23989 Human Factors Research, Inc., Los Angeles, Calif.
SOME OBSERVATIONS FROM A LITERATURE REVIEW TO ANTICIPATE BIOLOGICAL PROBLEMS THAT MIGHT ARISE IN SUSTAINED AND CONTINUOUS OPERATIONS
James F. OHanlon *In* Human Eng. Labs. Mil. Requirements for Res. on Continuous Operations Apr. 1972 p 116-132 refs (For availability see N73-23981 14-34)
(Contract DAHC04-71-C-0015)

N73-23990 Texas Technological Univ., Lubbock.
PHYSIOLOGICAL RESPONSE TO PROLONGED MUSCULAR ACTIVITY
M. M. Ayoub, Ed Burkhardt, Gene Coleman, and Nancy Bethea *In* Human Eng. Labs. Mil. Requirements for Res. on Continuous Operations Apr. 1972 p 133-187 refs (For availability see N73-23981 14-34)
(Contract DAAD05-69-C-0102)

06 CHEMISTRY

Includes chemical analysis and identification (e.g. spectroscopy). For applications see: 17 Materials, Metallic; 18 Materials, Nonmetallic; and 27 Propellants.

N73-23091# Chemical Lab. RVO-TNO, Rijswijk (Netherlands).
KINETICS OF DECOMPOSITION OF ADSORBED SARIN DETERMINED MICROCALORIMETRICALLY
J. J. G. M. VanBokhoven Oct. 1972 30 p refs In DUTCH; ENGLISH summary
(Rept-1972-18) Avail: NTIS HC $3.50

Heat production of sarin adsorption upon gamma-alumina and of the subsequent decomposition reaction was measured by a microcalorimeter. It is reported that adsorption causes a heat effect of a few minutes. Because of thermal inertia, however, the signal lasts for about 200 minutes. Hereafter a continuous heat production becomes observable, which originates from defluoridation of sarin. The rate of this reaction is unusual: dc/dt is proportional to 1/t. It may be explained by means of a mode which the active surface sites of the alumina show a distribution in the energy of activation for defluoridation. The kinetics cannot be understood completely from microcalorimetric measurements before the line shape can be corrected for its broadening by thermal inertia. Author

N73-23092# National Bureau of Standards, Washington, D.C. Physical Chemistry Div.
SELECTED VALUES OF CHEMICAL THERMODYNAMIC PROPERTIES. TABLES FOR THE LANTHANIDE (RARE EARTH) ELEMENTS. (ELEMENTS 62 THROUGH 76 IN THE STANDARD ORDER OF ARRANGEMENT)
R. H. Schumm, D. D. Wagman, S. Bailey, W. H. Evans, and V. B. Parker Apr. 1973 90 p refs
(NBS-TN-270-7) Avail. SOD $1.25 Domestic Postpaid or $1.00 GPO Bookstore as C13.46:270-7

Tables of values are given for the standard heats and Gibbs (free) energies of formation, entropies, and enthalpies at 298.15 K, and heats of formation at 0 K for compounds of the rare-earth elements (the lanthanides; lutetium through lanthanum; elements 62 through 76 in the Standard Order of Arrangement). Author

N73-23093*# Little (Arthur D.), Inc., Cambridge, Mass.
ODOR INTENSITY AND CHARACTERIZATION OF JET EXHAUST AND CHEMICAL ANALYTICAL MEASUREMENTS Technical Report, Mar. 1972 - Mar. 1973
David A. Kendall and Philip L. Levins Mar. 1973 69 p refs (Contract NAS3-15701)
(NASA-CR-121159; ADL-74443) Avail: NTIS HC $5.50 CSCL 07D

Odor and chemical analyses were carried out on the exhaust samples from a J-57 combustor can operated over a range of inlet conditions, and with several fuel types and nozzle modifications. The odor characteristics and total intensity of odor for each exhaust were determined over a range of dilutions to allow for a least squares determination of the intensity at 1,000 to 1 dilutions. Analytical measures included the concentration of total hydrocarbons and the concentrations of aromatic organic species and oxygenated organic species from collected samples which were taken concurrently. A correlation was found between the concentration of the odorous oxygenated fraction and the total intensity of aroma. Inlet operating conditions and nozzle modifications which increase the efficiency of combustion as measured by exhaust gas analyses reduce the odor intensity and the quantity of oxygenates in the exhaust. The type of fuel burned altered the intensity of odor in relation to the quantity of oxygenates produced and, in some instances, changed the odor character. Author

N73-23094# National Bureau of Standards, Washington, D.C. Chemical Kinetics Information Center.
A SUPPLEMENTARY BIBLIOGRAPHY OF KINETIC DATA ON GAS PHASE REACTIONS OF NITROGEN, OXYGEN, AND NITROGEN OXIDES Final Report
Francis Westley Feb. 1973 92 p refs
(NBS-SP-371; LC-72-600272) Avail: SOD $1.25 Domestic Postpaid or $1.00 GPO Bookstore

A bibliography is provided for published papers and reports, containing rate data for reactions of N, N2, N3, N2O, N2O2, N2O3, N2O4, NO, NO2, NO3, NO4, O, O2 and O3 with each other. It includes an extensive list of papers dealing with production and reactions of molecular oxygen in excited singlet state. In addition, two lists of critical reviews dealing with the above reactions are included. About 500 papers are listed. The period covered extends from 1900 through January 1972. Author

N73-23095# Defence Research Information Centre, Orpington (England).
THE STRUCTURE AND CHEMICAL COMPOSITION OF COMPOUNDS FORMED ON THE SURFACE OF METALS IN THE PRESENCE OF COMPLEX FORMING REAGENTS
N. G. Klyuchnikov et al Jan. 1973 10 p refs Transl. into ENGLISH from Uch. Zap. Mosk. Gos. Pedagog. Inst., Moscow v. 340, 1971 p 278-285
(DRIC-Trans-3020; BR-30384) Avail: NTIS HC $3.00

Phase compounds were formed on the surface of Armco iron, zinc, copper, and cobalt surfaces in the presence of organic complex forming reagents such as cupferron, 8-hydroxy quinoline, benzotriale, and alpha nitroso beta naphtol. Some of these reagents by forming thick films with good adhesion to the metal, considerably reduced the rate of the corrosive process. An X-ray study was made of these phase compounds. The identity of the phase compounds formed in heterogeneous reactions of metals with the reagents mentioned with complex compounds obtained in solutions was established. The results obtained were confirmed by data from elementary chemical and spectrophotometric analyses. ESRO

N73-23096# Fraunhofer-Gesellschaft zur Forderung der Angewandten Forschung e. V., Grafschaft (West Germany). Inst. fuer Aerobiologie.
EVAPORATION OF WATER DROPLETS IN AEROSOL JET DEVICES [DAS VERDAMPFEN KLEINER TROPFEN IN AEROSOLSTRAHLAPPARATUREN]
B. E. Dahneke, H. Flachsbart, F. J. Moenig, and N. Schwarzer Bonn Bundeswehramt 1973 15 p refs In GERMAN; ENGLISH summary Sponsored by Bundesmin. der Verteidigung
(BMVg-FBWT-73-5) Avail: NTIS HC $3.00; Bundeswehramt, Bonn. 25 DM

In order to investigate the evaporation of droplets in aerosol

jets, an experiment has been set up to study the motion of latex spheres in a vacuum chamber. Exact measurements of latex sphere trajectories in rarefied air showed a surprising property of aerosol jets: the particles and drops in the jet are considerably cooled off when the aerosol gas suddenly expands within the vacuum chamber used to produce the jet. The calculated temperature effects for latex spheres indicate that, due to a substantial reduction of temperature, the evaporation of water droplets is almost inhibited and the measurement of droplet aerosols is possible. ESRO

N73-23097# National Bureau of Standards, Washington, D.C.
THE THERMODYNAMICS OF CHEMICAL SPECIES IMPORTANT IN AEROSPACE TECHNOLOGY (INCLUDING SPECIAL TOPICS IN CHEMICAL KINETICS) Interim Report
Thomas B. Douglas and Charles W. Beckett 1 Jul. 1972 326 p refs
(AF Proj. 9750)
(AD-757518; NBS-10904; AFOSR-72-2004TR) Avail: NTIS CSCL 07/4

Contents: The heat of formation of MoF6(l) by solution calorimetry; Molybdenum pentafluoride-vaporization properties from transpiration; The vibrational spectra of molybdenum pentafluoride; The measurement of the relative enthalpy of Mo2C from 273.15 to 1475 K; High-speed (subsecond) simultaneous measurement of specific heat, electrical resistivity, and hemispherical total emittance of tantalum-10 (WT. %) tungsten alloy in the range 1500 to 3200 K; Simultaneous measurement of specific heat, electrical resistivity, and hemispherical total emittance of niobium-1 (WT. %) zirconium alloy in the range 1500 to 2700 K; Measurement of melting point and electrical resistivity (above 3600 K) of tungsten by a pulse heating method; Measurement of melting point, Normal spectral emittance (at melting point), and electrical resistivity (above 2650 K) of niobium; A pulse heating technique for the measurement of heat of fusion of metals; Rate constants for the reactions-(M)+NH3 = NH2(radical) +H(radical) + (M), (M)+ N2H4 = 2NH2 (radical) + (M), and (M) + N2F4 = 2NF2 (radical) + (M); Chemical kinetics of reactions of chlorine, nitrogen and oxygen fluorides in gas phase a bibliography - 1934 through June 1972; and New ideal-gas thermochemical tables. GRA

N73-23098# Aerodyne Research, Inc., Burlington, Mass.
THE MEASUREMENTS OF THE ROTATIONAL RAMAN CROSS SECTION OF N2 AND O2 AT 10.6 MICRONS Semiannual Report
Morton Camac and Robert C. Sepucha Feb. 1973 54 p refs
(Contract N00014-73-C-0025; DARPA Order 1806)
(AD-757111; ARI-RR-22) Avail: NTIS CSCL 07/4

An experimental facility was constructed to measure the rotational Raman scattering cross sections of N2 and O2 at 10.6 microns. The system was designed to measure the Raman cross sections relative to the CO2 radiative absorption cross section in the 10.4-micron band. Static and dynamic calibrations of the system were devised to determine the importance of scattering from walls and dust relative to the Rayleigh and Raman components of the radiation scattered from the gas. Author (GRA)

N73-23099# Stanford Research Inst., Menlo Park, Calif.
EXCITATION AND DEEXCITATION OF VIBRATION IN GASES BY OXYGEN AND NITROGEN ATOMS Final Report
Graham Black and Donald J. Eckstrom 16 Feb. 1973 76 p refs
(Contract DAHC04-72-C-0015; ARPA Order 1482; SRI Proj. PYU-1664)
(AD-757050) Avail: NTIS CSCL 07/4

The earth's upper atmosphere continuously emits infrared radiation. Some of this radiation is powered by the energy stored in vibrationally excited nitrogen that can be produced by a number of exothermic processes. One of these processes is the reaction NO - N to N2 - O, in which 3.27 eV is available for vibrational and rotational energy of the N2 product as well as for kinetic energy. Once produced, the vibrationally excited nitrogen is deexcited only by collisions. In the E region, one important quenching mechanism is energy transfer to CO2, the rate for which is moderately well known. A second important deexcitation mechanism was considered to be V-T energy exchange with O (triplet P). At the start of this research program, the rate coefficients for this latter process were only known for translational temperatures far higher than are found in the earth's atmosphere. The report discusses the measurement of this rate down to as low a temperature as possible by the use of a shock tube with ozone as the source of atomic oxygen and the infrared-tracer method to monitor the vibrational energy in the nitrogen. GRA

N73-23100# Bishop Coll., Dallas, Tex.
RADIATION INDUCED GRAFTING ON POLYAMIDES
J. E. Wilson Mar. 1973 40 p refs
(Contract N00014-72-C-0052; NR Proj. 356-520)
(AD-757376; TR-2) Avail: NTIS CSCL 07/3

The report describes the continuation of the investigation of the radiation-induced grafting of fluorinated monomers on polyamide films. One objective of the present work was to investigate the nature of the accelerating effect of methanol, and the effect of added solvents in general. Another objective was to study the properties of nylon films containing grafted PFS. Experimental approaches induced the comparison of grafting rates for the PFS/nylon system with those for PFS/polyethylene, styrene/nylon, and styrene/polyethylene. (Author Modified Abstract) GRA

N73-23101# Purdue Univ., Lafayette, Ind. Thermophysical Properties Research Center.
TRANSPORT PROPERTIES OF SELECTED ELEMENTS AND COMPOUNDS IN THE GASEOUS STATE Interim Report
Peter E. Liley Nov. 1972 78 p refs
(Grant AF-AFOSR-2396-72; AF Proj. 9750)
(AD-757528; TPRC-20; AFOSR-73-0478TR) Avail: NTIS CSCL 07/4

Tables of viscosity, thermal conductivity and diffusion coefficient have been prepared for thirty-eight binary mixtures and for nine pure substances, the latter comprising helium, atomic and molecular hydrogen, atomic and molecular deuterium, atomic and molecular fluorine, hydrogen fluoride and deuterium fluoride. Most of the binary mixtures are combinations of these substances. The temperature range was from 100 to 3000K. For the pure substances, the most recent recommendations were used and for the mixtures, the Lennard-Jones 6-12 potential was used for viscosity and diffusion, and a linear mixing rule was employed for thermal conductivity. The precision of the tabulated values is reviewed. The present state-of-the-art in predicting these properties is briefly surveyed. It is concluded that significant discrepancies can still exist between theoretical and experimental quantities. Author (GRA)

N73-23102# Aerospace Corp., El Segundo, Calif. Lab. Operations.
TEMPERATURE DEPENDENCE OF SOLUBILITIES OF ELECTROLYTES AND NONELECTROLYTES Technical Report, Jun. - Sep. 1972
Nev A. Gokcen and Elfreda T. Chang 7 Mar. 1973 23 p refs
(Contract F04701-72-C-0073)
(AD-757504; TR-0073(3240-20)-2; SAMSO-TR-73-83) Avail: NTIS CSCL 07/4

A critical evaluation of the existing methods of representing the temperature dependence of sparingly soluble electrolytes and nonelectrolytes has been made. A method of much greater accuracy has been formulated and tested with the data on the solubilities of AgCl, AgBr, S8, N2, O2, Ar, and CO2 in liquid solvents. Author (GRA)

N73-23103# McDonnell-Douglas Astronautics Co., Huntington Beach, Calif.
THERMOCHEMISTRY OF HIGH TEMPERATURE GASEOUS COMPOUNDS OF METALS Final Technical Report, 1 Jun. - 15 Aug. 1972
Donald L. Hildenbrand 15 Aug. 1972 6 p
(Contract F44620-72-C-0074; AF Proj. 9750)
(AD-757231; AFOSR-73-0435TR) Avail: NTIS CSCL 07/2

Measurements were made by high temperature mass spectrometry, both equilibrium and electron impact studies, to obtain thermochemical data for gaseous compounds of refractory metals. Gaseous SF6 was admitted to a tungsten effusion cell,

equilibrium was established at 1600K and gaseous products of WF6, WF5, WF4, WSF2, WSF3, WSF4, WS2F2 and WOSF2 were identified and characterized. Author (GRA)

N73-23104# Bureau of Mines, Reno, Nev. Reno Metallurgy Research Center.
STABILITY CONSTANTS OF METAL COORDINATION COMPOUNDS, COMPLEXES OF N-ETHYLETHYLENEDIAMINE AND 2-(ETHYLTHIO)-ETHYLAMINE
David J. MacDonald, Alexander May, and E. G. Baglin Washington Nov. 1972 24 p refs
(PB-213951/8; BM-RI-7694) Avail: NTIS HC $3.00 CSCL 07B

Stability constants, that is, equilibrium constants for complex formation reactions, were determined by a titrimetric method for complexes formed by the transition metal ions Ni (2+), Cu (2+), Zn (2+), and Cd (2+) with the structurally analogous bidentate ligans n-ethylethylenediamine and 2-(ethylthio)-ethylamine. The sulfur containing ligand was found to be the weaker of the two chelating agents for each of the four metals. Absorption spectra of the individual complexes were determined in order to calculate their crystal field stabilization energies. The combined results suggest a linear relation between free energy of chelation and ionic radius of the metal ion. Author (GRA)

N73-23105# Georgia Inst. of Tech., Atlanta. Engineering Experiment Station.
JET EXHAUST REACTIONS: A THEORETICAL STUDY Final Report, 1 Jul. - 31 Dec. 1972
Edward Y. H. Keng and Clyde Orr, Jr. 31 Jan. 1973 23 p refs
(Contract F19628-72-C-0353; GIT Proj. A-1437; AF Proj. 7605)
(AD-758200; AFCRL-TR-73-0110) Avail: NTIS CSCL 07/4

The objective of the project was to find an appropriate means for temporarily reducing the temperature of engine exhaust gases while holding to a minimum the infrared spectral emission in the reaction products at the exhaust temperature. The most promising approach appears to involve the injection of materials that undergo endothermic decomposition. Only limited data on endothermic decomposition were found in the literature. However, heat of decomposition values can be calculated from heat of formation data which is much more readily available. Some promising substances were tested by injecting their powders into a hot gas stream and measuring the temperature reduction thereby induced. Preliminary calculations based on these measurements indicate, typically, that engine exhaust temperature reductions of about 100F can be achieved for each 1 lb/sec of powder injected. The emission spectra of materials and their reaction products are also discussed. Author (GRA)

N73-23604 Central Inst. for Industrial Research, Oslo (Norway).
TRANSPORT PROCESSES IN SCALES IN HIGH TEMPERATURE CORROSION
P. Kofstad *In* AGARD High Temp. Corrosion of Aerospace Alloys Mar. 1973 p 97-116 refs (For availability see N73-23597 14-17)

N73-23606 Yale Univ., New Haven, Conn. Dept. of Engineering and Applied Science.
ENVIRONMENTAL EFFECTS ON GAS/METAL REACTIONS AT ELEVATED TEMPERATURES
D. E. Rosner *In* AGARD High Temp. Corrosion of Aerospace Alloys Mar. 1973 p 129-144 refs (For availability see N73-23597 14-17)

N73-23607 Ohio State Univ., Columbus.
VAPORIZATION LOSSES FROM Cr_2O_3 PROTECTIVE SCALES
R. A. Rapp *In* AGARD High Temp. Corrosion of Aerospace Alloys Mar. 1973 p 147-154 refs (For availability see N73-23597 14-17)

N73-23610 Admiralty Materials Lab., Poole (England).
WHAT ARE THE SEPARATE AND INTERACTING ROLES OF SULPHUR, SODIUM AND CHLORIDE IN HOT CORROSION?
J. F. G. Conde *In* AGARD High Temp. Corrosion of Aerospace Alloys Mar. 1973 p 203-220 refs (For availability see N73-23597 14-17)

N73-23611 Centre National de Recherches Metallurgiques, Liege (Belgium).
WHAT ARE THE EFFECTS OF ALLOYING ELEMENTS SINGLY OR IN COMBINATION ON HOT CORROSION?
A. Davin and D. Coutsouradis *In* AGARD High Temp. Corrosion of Aerospace Alloys Mar. 1973 p 221-233 refs (For availability see N73-23597 14-17)

N73-23612 Naval Ship Research and Development Center, Annapolis, Md.
ARE COBALT-BASE ALLOYS INTRINSICALLY MORE RESISTANT TO HOT CORROSION THAN ALLOYS BASED ON NICKEL?
W. L. Wheatfall *In* AGARD High Temp. Corrosion of Aerospace Alloys Mar. 1973 p 235-254 refs (For availability see N73-23597 14-17)

N73-23973* Jet Propulsion Lab., Calif. Inst. of Tech., Pasadena.
THERMOLUMINESCENCE: POTENTIAL APPLICATIONS IN FORENSIC SCIENCE
J. D. Ingham and D. D. Lawson *In its* Quart. Tech. Rev., Vol. 2, No. 4 Jan. 1973 p 18-28 refs (For availability see N73-23970 14-34)
CSCL 07D

07 COMMUNICATIONS

Includes communications equipment and techniques; noise; radio and communications blackout; modulation telemetry; tracking radar and optical observation; and wave propagation. For basic research see: 23 Physics, General; and 21 Navigation.

N73-23106*# Jet Propulsion Lab., Calif. Inst. of Tech., Pasadena.
HIGH ISOLATION RF SIGNAL SELECTION SWITCHES Patent Application
Michael F. Hanna and Harry K. Detweiler, inventors (to NASA) Filed 27 Mar. 1973 18 p
(Contract NAS7-100)
(NASA-Case-NPO-13081-1; US-Patent-Appl-SN-345372) Avail: NTIS HC $3.00 CSCL 17B

Development is reported of RF signal selection switches having greater than 70 db isolation between a selected input terminal and other nonselected RF input terminals, and between the selected input and an output terminal. Over 100 db isolation is achieved at frequencies up to 30 MHz. Application of the invention includes any commercial, military, or space system where switching by low level control signals is desired. NASA

N73-23107# Lockheed Missiles and Space Co., Palo Alto, Calif.
ON LIGHT SIGNALLING FROM LONG RANGE SPACE VEHICLES
M. Z. Novikov [1972] 15 p refs Transl. into ENGLISH from the book "Apparatura dlia Kosmicheskikh Issledovanii" Moscow, Nauka, 1972 p 161-172
Avail: NTIS HC $3.00; National Translations Center, John Crerar Library, Chicago, Illinois 60616

A study was made of light contacts with long range space vehicles at a distance on the order of several hundreds of thousands of kilometers from earth, particularly with space vehicles flying between earth and the moon. The slight glint of a long range space vehicle poses a problem of providing onboard light signalling facilities. The possibilities of providing such facilities are examined. Some questions of constructing units for the reception of light signals are also examined. Author

N73-23108# Advisory Group for Aerospace Research and Development, Paris (France).
RADOMES, ADVANCED DESIGN
O. Tornani, ed. Mar. 1973 157 p refs
(AGARD-AR-53) Avail: NTIS HC $10.00

The techniques of radome design are summarized and a

model for radome specifications is presented. The subjects discussed are: (1) environmental design; (2) electrical design; and (3) materials for radome design. Graphs are developed to show radome characteristics under various conditions. Mathematical models are developed to support the theoretical considerations. Author

N73-23109# Australian Post Office Research Labs., Melbourne.
SYSTEM PARAMETERS FOR A REMOTE AREA TELEPHONE AND TELEVISION SERVICE
M. Balderston Sep. 1972 19 p refs
(Rept-6741) Avail: NTIS HC $3.00

The possibility of providing communications to remote areas is one of the major benefits of a satellite system. Operating frequencies and radiated power limits set by I.T.U. regulations for such services are discussed. Sample link calculations are presented, to give estimates of system requirements for television service, and to compare several possible modulation and multiplexing methods for telephony. Since such things as receiver noise temperatues, satellite transmission system losses, and so forth, are not known with great accuracy at present, the results should not be taken as conclusive. They do indicate that frequencies below 10 GHz offer certain advantages over those above, that I.T.U. limitations do not exclude the possibility of providing the remote area services, that television service is possible but probably not practicable at present, and that some types of telephony systems could be implemented using existing spacecraft. Author

N73-23110# Physics Lab. RVO-TNO, The Hague (Netherlands).
CALCULATION OF THE IMPENDANCE AND THE FAR FIELD OF A SHORT HELIX ANTENNA ABOVE AN INFINITE GROUNDPLANE AND COMPARISON WITH MEASUREMENTS
H. A. J. M. VanHoof Aug. 1972 51 p refs In DUTCH; ENGLISH summary
(PhL-1972-27) Avail: NTIS HC $4.75

A method of calculating the footpoint impedance and the far field of a small helix antenna above an infinite groundplane is provided. The calculated impedances are compared with the results of measurements. The computer program is also discussed. Author

N73-23111# Canadian Air Transportation Administration, Ottawa. Telecommunications and Electronics Branch.
[RESEARCH PROGRESS ON TELECOMMUNICATIONS AND ELECTRONIC SYSTEMS] Quarterly Progress Report, period ending 30 Jun. 1972
30 Jun. 1972 25 p
(Rept-73-00567) Avail: NTIS HC $3.25

Engineering progress is reported in the following areas: radar and automation systems, enroute aids, approach and landing aids, flight calibration, communications, ship electronics, and reliability and quality assurance. D.L.G.

N73-23112# Electrotechnical Lab., Tokyo (Japan).
STUDIES ON A WOVEN TYPE PLATED WIRE MEMORY
Matsuo Nitta Jul. 1972 105 p refs In JAPANESE; ENGLISH summary
(Rept-732) Avail: NTIS HC $7.25

A plated thin magnetic film wire element is described for use in high-speed main memories. A 4K-word main memory, which utilizes woven-type plated wire matrixes was constructed. The matrix used for the memory is fabricated by weaving the plated wires, which have the circumferential easy-axis direction as digit lines and the insulated copper wires as word lines. Thirty-two matrixes of this type, containing 128 words and 50 bits per word in each plane, are stacked into two blocks for a total 4K-word capacity. The specifications and characteristics of the memory system and the stack are provided. Author

N73-23113# RAND Corp., Santa Monica, Calif.
INFORMATION THEORY AND PRIVACY IN DATA BANKS
I. S. Reed Jan. 1973 26 p refs
(P-4952) Avail: NTIS HC $3.50

The problem of providing privacy transformations for data banks and retrieval systems falls into two modern disciplines: information theory and computer science. Here it is shown that measures of privacy can be drawn from information theory and, in particular, from rate distortion theory. It is demonstrated that a rate distortion function or the minimum mutual information about a record, conveyed by a distorted version of the record, is a natural measure of privacy. Shannon's conditions for perfect secrecy are met if the average mutual information about an original record R, given a distorted version E, is zero. Author

N73-23114# Lockheed Missiles and Space Co., Palo Alto, Calif.
ADDRESS-CODE COMMUNICATION SYSTEMS
N. D. Bosyi [1973] 7 p Transl. into ENGLISH from the book "Mnogokanalny Sistemy Peredachi Informatsii" Kiev, Tekhn. 1971 p 191-198
Avail: NTIS HC $3.00; National Translations Center, John Crerar Library, Chicago, Illinois 60616

Address code systems are an original multichannel wideband system of radio communications with code separation. The advantages of the address code system are: High interference immunity of the long range multichannel radio communications, simplicity of utilization, cheapness of the equipment, free access of subscribers to a common channel, simplicity of increasing the quantity of system subscribers, the possibility of direct communications between any subscribers and the central station when it is present, the possibility of operative communications with a group of subscribers, the control of system operation by using a special intermission code, the negligible influence of the Doppler effect, and the possibility of constructing secret communications systems. Author

N73-23115# Lockheed Missiles and Space Co., Palo Alto, Calif.
INFLUENCE OF LINEAR CHANNELS ON THE CORRELATION PROCESSING OF PHASE MANIPULATED SIGNALS
V. I. Vinokurov and R. A. Vakker [1973] 18 p refs Transl. into ENGLISH from the book "Voprosy Obrabotki Slozhnykh Signalov v Korrelatsionnykh Sistemakh" Moscow, Sov. Radio, 1970 p 187-210
Avail: NTIS HC $3.00; National Translations Center, John Crerar Library, Chicago, Illinois 60616

The use of correlation processing of phase-manipulated signals is reported as requiring investigation of the influence of linear filter parameters in correlator channels on the measured mutual-correlation function. Further, the absence of matching of the filter frequency characteristics to the signal spectra is said to result in systematic errors in measuring the signal delay because of the difference in the group delays in both channels. This investigation is limited to an analysis of the normalized mutual correlation function for the case when the linear filters are n-stage resonance amplifiers, each of whose stages has the transfer coefficient of a single-loop amplifier. J.M.M.

N73-23116# Lockheed Missiles and Space Co., Palo Alto, Calif.
METHODS OF ANALYZING DISRUPTION OF TRACKING: FOREWORD
G. V. Obrezkov and V. D. Razevig [1973] 12 p refs Transl. into ENGLISH from the book "Metody Analiza Sryva Slezheniia" Moscow, Sov. Radio, 1972 12 p
Avail: NTIS HC $3.00; National Translations Center, John Crerar Library, Chicago, Illinois 60616

The analytical investigation of tracking disruption is based on the theory of Markov stochastic processes. A Markov model is constructed for computing the probability of tracking disruption that uses a stochastic differential equation to characterize the time change in tracking error in an automatic regulation system; the solution of this equation is a random function of time because of the presence of noise. G.G.

N73-23117*# Scientific Translation Service, Santa Barbara, Calif.
AN INVESTIGATION OF COMPACT RADIO EMISSION SOURCES AT A WAVELENGTH OF 3.55 CM
D. D. Broderick, L. D. Jones, V. L. Efanov, K. I. Kellermann, B. G. Clark, L. R. Kogan, V. I. Kostenko, M. N. Cohen, L. I. Matveyenko, and I. G. Moiseyev Washington NASA May 1973 33 p refs Transl. into ENGLISH of "Issledovaniye Kompaktnykh Isotochnikov Kosmicheskogo Radioizlucheniya na Volne 3,55 CM", Acad. of Sci. USSR, Inst. of Space Res., Moscow, report Pr-117 (Contract NASw-2483)
(NASA-TT-F-14902; Pr-117) Avail: NTIS HC $3.75 CSCL 20N

The results are presented of observations of the compact components of quasars and the nuclei of radio galaxies made with a radio interferometer having limiting angular resolution. The measurements were made at a wavelength of 3.55 cm by the method of long-distance interferometry with the 22-meter radio telescope of the U.S.S.R. Academy of Sciences Crimean Astrophysical Observatory (KAO), the 42-meter NRAO (USA) telescope, and the 64-meter NASA (USA) telescope. In the majority of cases, the compact components have a complex structure. A number of the components have angular dimensions < 0.00025 and linear dimensions < 3 light months. Their brightness temperatures exceed 10 to the 12th power K. The brightness temperatures of the resolved components lie within the range of 10 to the 11th power to 10 to the 12th power K. Author

N73-23118*# Jet Propulsion Lab., Calif. Inst. of Tech., Pasadena.
COHERENT RECEIVER EMPLOYING NONLINEAR COHERENCE DETECTION FOR CARRIER TRACKING Patent Application
Marvin K. Simon and William C. Lindsey, inventors (to NASA) Filed 10 May 1973 38 p
(Contract NAS7-100)
(NASA-Case-NPO-11921-1; US-Patent-Appl-SN-359039) Avail: NTIS HC $4.00 CSCL 17B

The development of a generic model of a coherent receiver which may be adapted for particular applications by selecting the feedback signals to be added is reported. NASA

N73-23119# Institute of Electrical and Electronics Engineers, New York.
THE 1972 CONFERENCE ON SPEECH COMMUNICATION AND PROCESSING
Caldwell P. Smith, ed. 22 Feb. 1972 470 p refs Conf. held at Newton, Mass., 24-26 Apr. 1972 Prepared in cooperation with AFCRL
(AF Proj. 4610)
(AD-742236; IEEE-72-CHO-596-7-AE; AFCRL-72-0120; AFCRL-SR-131; Rept-73-00807) Avail: NTIS HC $25.50 CSCL 17/2

Papers submitted by U.S. and overseas authors in connection with the jointly sponsored international conference are presented. Papers are grouped in accordance with the conference sessions: speech aids for the blind, speech analysis and communication, speech recognition, speech synthesis, speech intelligibility and quality evaluation, speech perception and measurement, speech aids for the deaf, speech analysis and synthesis, and various topics in speech processing. There is also a report on a survey of speech processing research and development activities, that was undertaken in connection with the conference. For individual titles, see N73-23120 through N73-23234.

N73-23120 Institute of Electrical and Electronics Engineers, New York.
SURVEY OF SPEECH PROCESSING ACTIVITY
H. Levitt and C. F. Teacher *In its* The 1972 Conf. on Speech Commun. and Process. 22 Feb. 1972 p 1-13 (For availability see N73-23119 14-07)

The results are summarized of a survey conducted to determine the extent and nature of speech processing activity in this country and abroad. These results include the responses obtained from 115 questionnaires and cover the activities of some 200 researchers. D.L.G.

N73-23121 Haskins Labs., Inc., New York.
SPEECH READING MACHINES FOR THE BLIND. 1: THE CASE FOR AN AUTOMATIC READING SERVICE
P. W. Nye *In* IEEE The 1972 Conf. on Speech Commun. and Process. 22 Feb. 1972 p 16-18 (For availability see N73-23119 14-07)

Five basic questions are dealt with which arise whenever consideration is given to the matter of providing reading machines for blind people. Why build reading machines at all? Why need they be made to speak? How many will be needed? How will they be utilized? Are they economically feasible? Author

N73-23122 Massachusetts Inst. of Tech., Cambridge.
SPEECH READING MACHINES FOR THE BLIND. 2: THE TECHNICAL PROBLEMS AND THE METHODS ADOPTED FOR THEIR SOLUTION
Jonathan Allen *In* IEEE The 1972 Conf. on Speech Commun. and Process. 22 Feb. 1972 p 19-22 refs (For availability see N73-23119 14-07)

The characteristics of an ideal machine are given and the problem areas in developing a system meeting these requirements are defined. The areas in which technological progress must be made in order to attain the goals of an ideal system include; character recognition, morphological analysis, parsing, and speech synthesis. Each of these areas is dealt with on the basis of its current status and from the standpoint of needed refinement requiring fundamental or engineering innovations. D.L.G.

N73-23123 Haskins Labs., Inc., New York.
FIELD EVALUATION OF AN AUTOMATED READING SYSTEM FOR THE BLIND
P. W. Nye, J. D. Hankins, T. Rand, I. G. Mattingly, and F. S. Cooper *In* IEEE The 1972 Conf. on Speech Commun. and Process. 22 Feb. 1973 p 23-26 refs Prepared in cooperation with Conn. Univ. (For availability see N73-23119 14-07)

A system is described that produces synthetic speech from written text. The entire process is carried out automatically by a computer and associated special-purpose devices. A brief overview is presented of all of the stages involved in the text-to-speech conversion. Although the system is presently in the laboratory stage, the technology for operational status has been developed and is discussed. The potential of the system is assessed and evaluation studies to determine feasible applications are proposed. D.L.G.

N73-23124 Haskins Labs., Inc., New York.
WORD AND PHRASE STRESS BY RULE FOR A READING MACHINE
Jane H. Gaitenby, George N. Sholes, and Gary N. Kuhn *In* IEEE The 1972 Conf. on Speech Commun. and Process. 22 Feb. 1972 p 27-29 Sponsored by Veterans Admin. (For availability see N73-23119 14-07)

The technicalities are described of providing a reading machine, that produces synthetic English speech, with the capability of stressing its words and phrases in a manner appropriate to general American English. The approach currently in use, based on Mattingly's Speech Synthesis by Rule program, is demonstrated. D.L.G.

N73-23125 Bell Telephone Labs., Inc., Murray Hill, N.J.
AUTOMATIC SYNTHESIS FROM ORDINARY ENGLISH
C. H. Coker, N. Umeda, and C. P. Browman *In* IEEE The 1972 Conf. on Speech Commun. and Process. 22 Feb. 1972 p 30-33 refs (For availability see N73-23119 14-07)

A system is described which is used for speech synthesis from ordinary English text. The process is hierarchical. First, pauses are assigned within the sentence; then certain words are selected for a kind of key word or emphatic stress. Stress assignments are made to other words, and then these higher-level assignments are interpreted at successively lower levels which include syllable, phoneme, and time interval. The final step of the process involves the use of a digital synthesizer. D.L.G.

N73-23126 University Coll. of North Staffordshire, Keele (England). Dept. of Communication.
A SYSTEM FOR CONVERTING ENGLISH TEXT INTO SPEECH
W. A. Ainsworth *In* IEEE The 1972 Conf. on Speech Commun. and Process. 22 Feb. 1972 p 34-37 refs (For availability see N73-23119 14-07)

A system for generating speech from text punched on paper tape has been implemented using a small digital computer and a parametric speech synthesizer. The English text is first translated into a string of phonemic symbols and stress marks, using context cues to resolve as many ambiguities as possible, then this string of symbols is converted by a synthesis-by-rule program into the parameter values required for driving an analog speech synthesizer. The errors which are introduced at each stage are discussed, and their influence on the intelligibility and quality of the resulting speech is described. Author

N73-23127 British Columbia Univ., Vancouver. Dept. of Electrical Engineering.
OUTPUT SOUNDS FOR A DIGITAL SPELLED SPEECH READING MACHINE FOR THE BLIND
C. Y. Suen and M. P. Beddoes *In* IEEE The 1972 Conf. on Speech Commun. and Process. 22 Feb. 1972 p 38-41 refs (For availability see N73-23119 14-07)

Eliminating the redundant phonemes, letter sounds of the alphabet were synthesized by concatenation of 18 basic phonemes. This algorithm offers considerable saving of memory space and cost in constructing a digital spelled speech reading machine for the blind. For the experiments, a computer was used to synthesize the letter sounds and to simulate this machine. The experimental results indicate that blind subjects can read sentences between 60 and 70 words per minute with 90% correct intelligibility after only one hour of contact with these letter sounds. Author

N73-23128 Massachusetts Inst. of Tech., Cambridge.
RECENT IMPROVEMENTS IN BRAILLE TRANSCRIPTION
Jonathan Allen *In* IEEE The 1972 Conf. on Speech Commun. and Process. 22 Feb. 1972 p 42-44 refs (For availability see N73-23119 14-07)

The shortcomings of Grade 2 Braille, presently used in the U.S., are discussed and an alternative system is evaluated. It is stated that the major difficulty with Braille 2 rules is that they are context-sensitive in an involved way. Restrictions on the rules are based on position of a letter-sequence within a word, pronunciation of the letter string, and syllabification. With the proposed system, words are decomposed into their basic atomic units called morphs. A complete algorithm has been developed to perform this task. The procedure requires a morph lexicon which is capable of representing a large sample of English text. It is felt that the use of morphemic decomposition combined with suffix sequence tests and Grade 2 rules will result in a more linguistically correct Braille which can be read more naturally, with greater speed, and less training, than the currently available Braille. D.L.G.

N73-23129 Institute of Electrical and Electronics Engineers, New York.
THE AMBICHRON: AN ELECTRONIC TIME COMPRESSOR FOR AUDIO
Richard F. Koch *In its* The 1972 Conf. on Speech Commun. and Process. 22 Feb. 1972 p 45-48 refs (For availability see N73-23119 14-07)

The problem of time-compression and expansion for audio is solved by means of electronic processing, which is compared with earlier techniques. An operating compressor/expander using digital technology is described, and criterions for bandwidth and dynamic range are given. In this device temporary storage is provided by a random-access memory, and pitch-correction is determined by a variable-frequency clock. A control signal is generated for the motor of a separate playback unit, to provide exact lock between rate and pitch-correction. Some applications of time compression and expansion are cited. Author

N73-23130 Bell Telephone Labs., Inc., Holmdel, N.J.
TIME INDUCED ORTHOGONALITY SIMPLIFIES VOICE CONTROL OF MACHINES
Clifford J. Hoffman *In* IEEE The 1972 Conf. on Speech Commun. and Process. 22 Feb. 1972 p 49-51 ref (For availability see N73-23119 14-07)

Ambiguities frequently encountered in speech recognition are removed by time separation of vocabulary elements. This time separation technique greatly simplifies the recognition problem such that in the simplest control scheme, only an energy threshold detector is required. The user synchronizes his voice input to active visual and/or audio feedback. Time induced orthogonality has the advantage that it can be made virtually insensitive to language and speaker variations. Refinements of the approach make it more user oriented and eventually take on many characteristics of traditional speech recognition. Author

N73-23131 Bell Telephone Labs., Inc., Murray Hill, N.J.
APPLICATION OF DIGITAL SIGNAL PROCESSING TO THE DESIGN OF A PHASE VOCODER ANALYZER
R. W. Schafer and L. R. Rabiner *In* IEEE The 1972 Conf. on Speech Commun. and Process. 22 Feb. 1972 p 52-55 refs (For availability see N73-23119 14-07)

Problems in the design and simulation of discrete-time systems for short-time Fourier analysis and synthesis are considered. In particular, several digital signal processing techniques are focused on that can be effectively utilized in software and hardware realizations of such speech processing systems. Author

N73-23132 Bell Telephone Labs., Inc., Murray Hill, N.J.
DESIGN AND IMPLEMENTATION OF AN ADAPTIVE DELTA MODULATOR
N. S. Jayant, P. Cummiskey, and J. L. Flanagan *In* IEEE The 1972 Conf. on Speech Commun. and Process. 22 Feb. 1972 p 56-58 refs (For availability see N73-23119 14-07)

A minimally complex adaptive delta modulator (ADM) with integrated circuit hardware was developed and made operational. The hardware realization of the ADM confirmed earlier predictions, on the basis of computer simulations, of an efficient encoder for speech signals at bit rates of 20 to 40 kbps. The salient features of the ADM are summarized, and the process is described by which the digital code format in ADM can be made compatible with the code format characteristic of nonadaptive, or linear delta modulation. Author

N73-23133 Philco-Ford Corp., Willow Grove, Pa.
A VOICING ADAPTIVE SPEECH DIGITIZATION TECHNIQUE
D. J. Jurenko, F. W. Newdeck, and C. F. Teacher *In* IEEE The 1972 Conf. on Speech Commun. and Process. 22 Feb. 1972 p 59-62 refs Sponsored in part by RADC (For availability see N73-23119 14-07)

The problem is examined of designing a speech digitization system which can effectively operate at a bit rate of 9600 bits/second, and where implementation complexity must be kept at a minimum. The goal of the project was to maximize the subjective quality of the speech emanating from the system rather than its intelligibility, since it was felt that the intelligibility of most systems at the bit rate contemplated would be satisfactory. Techniques considered during the study included simple delta modulation, various syllabically companded delta modulation techniques, differential PCM, and some simply implemented analog bandwidth compression techniques. The chosen system was based upon a voicing adaptive processor followed by a syllabically companded delta modulation system. The speech quality produced by the device at 9600 bits/second was judged to be better than that produced by a comparable delta modulation system operating at the same rate. Author

N73-23134 California Univ., Santa Barbara.
PITCH-SYNCHRONOUS TIME-COMPRESSION OF SPEECH
Robert J. Scott and Sanford E. Gerber *In* IEEE The 1972 Conf. on Speech Commun. and Process. 22 Feb. 1972 p 63-65 refs (For availability see N73-23119 14-07)

Speech time-compression is customarily accomplished by a sampling method which in no way respects what is being said. It is preferable to base sampling upon some property of speech or language. An investigation was made of the use of the fundamental vocal frequency to determine the sampling interval by the use of a Laryngograph, a device which acquires the fundamental directly. Programs were written to effect time-compression as a function of fundamental frequency. An intelligibility test containing only voiced sounds was developed and employed. Data are presented which demonstrate that such pitch-synchronous time-compression renders more intelligible speech than available with the usual sampling method. Author

N73-23135 Technischen Universitaet, Munich (West Germany). Inst. fuer Datenverarbeitung.
PITCH-SYNCHRONOUS, NONHARMONIC ANALYSIS OF SPEECH SIGNALS
Wolfgang J. Hess *In* IEEE The 1972 Conf. on Speech Commun. and Process. 22 Feb. 1972 p 66-69 refs (For availability see N73-23119 14-07)

The problems are considered of pitch-synchronous spectral analysis with arbitrary resolution in the frequency domain. The analysis is done by applying the FFT to single pitch periods prolonged by zero samples to provide the frequency resolution desired. Formant bandwidth is approximately determined by

measuring the natural damping of the waveform, thus enabling the algorithm to enhance the formants. Ripples in the spectrum, due to the truncation of the signal at the end of a pitch period, are suppressed by weighting the time function. In spite of enhancing and weighting, adjacent formants cannot be separated as two different peaks in the spectrum if their frequency difference is less than 1.325 times the fundamental frequency. Author

N73-23136 Carleton Univ., Ottawa (Ontario).
REAL TIME PITCH PERIOD EXTRACTION BY ADAPTIVE PREDICTION OF THE SPEECH WAVEFORM
J. N. Maksym *In* IEEE The 1972 Conf. on Speech Commun. and Process. 22 Feb. 1972 p 70-73 refs (For availability see N73-23119 14-07)

Excepting relatively high cost methods such as cepstrum analysis, the problem of reliable pitch period extraction has remained largely unsolved. The feasibility is examined of pitch period extraction by means of the nonstationary error process resulting from adaptive-predictive quantization of speech. A real-time hardware pitch period extractor which may be realized at a cost of less than $100 is described. Author

N73-23137 Pennsylvania Univ., Philadelphia.
A FORMANT EXTRACTION TECHNIQUE USING PREDICTIVE CODING
John D. Oetting *In* IEEE The 1972 Conf. on Speech Commun. and Process. 22 Feb. 1972 p 74-76 refs (For availability see N73-23119 14-07)

A relationship is established between the predictor coefficients of an adaptive linear predictor and the formant frequencies of the vocal tract. A procedure for calculating formant frequencies is developed. This procedure was applied to natural speech and the results are discussed briefly. Some relevant conclusions are presented. Author

N73-23138 Bolt, Beranek, and Newman, Inc., Cambridge, Mass.
ASPECTS OF LINEAR PREDICTION IN THE SPECTRAL ANALYSIS OF SPEECH
John Makhoul *In* IEEE The 1972 Conf. on Speech Commun. and Process. 22 Feb. 1972 p 77-80 refs Sponsored by ARPA (For availability see N73-23119 14-07)

Some of the properties are described of spectra derived by linear prediction of the sampled speech signal. The method is also compared with other methods of spectral analysis such as analysis by synthesis and cepstral smoothing. It is shown that this method can be regarded as another method of analysis by synthesis where a number of poles is specified, with the advantages of non-iterative computation and an error measure which leads to a better spectral envelope fit for an all-pole spectrum. Compared to spectral analysis with cepstral smoothing in conjunction with the chirp z-transform, this method is expected to give a better spectral envelope fit (for an all-pole spectrum) and to be less sensitive to the effects of high pitch on the spectrum. A conclusion concerning the windowing of the sampled signal follows directly from the spectral properties of this method. Author

N73-23139 Speech Communications Research Lab., Inc., Santa Barbara, Calif.
AUTOMATIC FORMANT AND FUNDAMENTAL FREQUENCY EXTRACTION FROM A DIGITAL INVERSE FILTER FORMULATION
John D. Markel *In* IEEE The 1972 Conf. on Speech Commun. and Process. 22 Feb. 1972 p 81-84 ref (For availability see N73-23119 14-07)
(Contract N00014-67-C-0118)

A new algorithm for automatically determining F sub o (the fundamental frequency), and F sub n, n = 1,2,3 (the first three formants), during regions of voicing, for male speech, is presented, along with a voiced-unvoiced decision algorithm. The approach is based upon a digital inverse filter formulation having the same properties as maximum likelihood and linear predictor methods. Author

N73-23140 Case Western Reserve Univ., Cleveland, Ohio. Dept. of Computing and Information Sciences.
ON THE ACCURACY OF FORMANT PARAMETER ESTIMATION BASED ON THE METHOD OF PRONY
Timothy J. Zebo and Wen C. Lin *In* IEEE The 1972 Conf. on Speech Commun. and Process. 22 Feb. 1972 p 85-88 refs (For availability see N73-23119 14-07)

The discrete method of Prony is used to represent sampled speech by complex exponential functions. Some of the conditions are discussed for which the extracted exponents provide accurate estimates of the formant frequencies and bandwidths of the speaker. Author

N73-23141 Threshold Technology, Inc., Cinnaminson, N.J.
AN ADAPTIVE ISOLATED WORD SPEECH RECOGNITION SYSTEM
Marvin B. Herscher and Robert B. Cox *In* IEEE The 1972 Conf. on Speech Commun. and Process. 22 Feb. 1972 p 89-92 refs (For availability see N73-23119 14-07)

A real-time adaptive system designed to classify test words based on the measurement of up to 32 speech parameters is described. For a given word, the time sequence of these features is stored in memory during the training cycle and later used for comparison with an unknown word during the test cycle. A minicomputer is used to time normalize word duration, perform adaption and to select a word in the vocabulary based upon a predetermined recognition algorithm. Accuracies of 98 to 99% correct decisions have been achieved for word vocabularies ranging from 10 to 25 words. Author

N73-23142 California Univ., Santa Barbara. Computer Research Lab.
ISOLATED WORD PHONEME RECOGNITION USING FEATURES DERIVED FROM WAVEFUNCTION PARAMETERS
Larry L. Pfeifer *In* IEEE The 1972 Conf. on Speech Commun. and Process. 22 Feb. 1972 p 93-96 refs (For availability see N73-23119 14-07)
(Contract DAHC04-71-C-0043)

A system is proposed in which the digitized speech word is filtered into five fixed-frequency bands and a wavefunction analysis performed on each, yielding five lists of parameters which describe the time behavior of the filtered substrings. From these parameters it is possible to determine, in a sequential manner, the presence of voicing. When the termination of the current voiced or unvoiced segment is detected, it is further processed for division into smaller segments (Phonemes) if necessary, and recognition features extracted for each. Using a data base of 268 recordings (1179 phonemes) for a single speaker, it was determined that, for the sampled speaker, an accuracy of 90 percent could be expected for twelve vowels, 86 percent for thirteen voiced consonants (/b,d,g/ indistinguishable and /v,th/ indistinguishable), and 90 percent for eight unvoiced consonants. Author

N73-23143 Defense Dept., Fort Meade, Md.
WORD RECOGNITION BY MEANS OF WALSH TRANSFORMS
Moyett T. Clark, John E. Swanson, and John A. Sanders *In* IEEE The 1972 Conf. on Speech Commun. and Process. 22 Feb. 1972 p 97-100 refs (For availability see N73-23119 14-07)

An experiment is described in which word recognition is based on comparing the Walsh sequency components of spoken words with those of a stored library of words. A Walsh transform computer program is used to calculate the sequency components of successive segments of spoken words. The components for each word to be recognized are arranged into an amplitude-sequency-time matrix and correlated against a set of test matrices. A test matrix is generated for each word by averaging six matrices of the word. By using the highest correlation coefficient to determine which word is spoken, recognition scores between 89.9% and 100% are achieved for a ten word vocabulary spoken by four speakers. Author

N73-23144 Hitachi, Ltd., Tokyo (Japan).
EVALUATION OF VARIOUS PARAMETERS IN SPOKEN DIGITS RECOGNITION
Y. Nakano, A. Ichikawa, and K. Nakata *In* IEEE The 1972 Conf. on Speech Commun. and Process. 22 Feb. 1972 p 101-104 refs (For availability see N73-23119 14-07)

To determine which is the most efficient parameter set for speech recognition, five parameter sets are evaluated experimentally in spoken digit recognition. The principle of the

recognition is a simple pattern match with nonlinear adjustment of time axis. Spectrum envelope and cepstrum give the best score of 100%, for spoken digits of a single speaker. Partial autocorrelation coefficients weighted by the amplitude information also show promising results. Author

N73-23145 Institute for Perception RVO-TNO, Soesterberg (Netherlands).
SEGMENTATION AND RECOGNITION ON MONOSYLLABIC WORDS
Louis C. W. Pols *In* IEEE The 1972 Conf. on Speech Commun. and Process. 22 Feb. 1972 p 105-108 refs (For availability see N73-23119 14-07)

Some preliminary results are given of a word recognition system based on a dimensional representation of the one-third octave spectra of the 15 msec samples of the spoken word. A segmentation algorithm looks for the stationary phoneme-like segments in the word. The average coordinate values of these segments in the optimal three-dimensional subspaces for sonorants and non-sonorants, are used for the final recognition. The system is tested with a list of 270 CVC words from a single speaker. Author

N73-23146 Purdue Univ., Lafayette, Ind.
AN APPROACH TO RESEARCH ON WORD SPOTTING IN CONTINUOUS SPEECH
G. W. Hughes, K.-P. Li, and T. B. Snow *In* IEEE The 1972 Conf. on Speech Commun. and Process. 22 Feb. 1972 p 109-112 refs (For availability see N73-23119 14-07)
(Contract F19628-69-C-0157)

The long-term objective of this study is to determine and evaluate feasible solutions and programmable procedures for automatic speech recognition. A scheme for word spotting in continuous speech is being studied based on short-term spectra. A primary recognition program was written to provide segmentation, acoustical parameters, and phonetic features in speech, together with classification of some vowel and consonantal segments. Based on fundamantal frequency, level, and duration information provided by the primary recognition program, a procedure to mark stressed and unstressed syllables and reduced vowels is proposed. Listener judgments of stress and vowel reduction can be correlated with the physical parameter, but talker differences are apparent. It is clear that feature extraction at the segment level and at the suprasegmental level are mutually interactive. Author

N73-23147 Sperry Rand Corp., St. Paul, Minn.
A PROCEDURE FOR THE MACHINE RECOGNITION OF SPEECH
Mark Medress *In* IEEE The 1972 Conf. on Speech Commun. and Process. 22 Feb. 1972 p 113-116 refs (For availability see N73-23119 14-07)

A hierarchical and fundamental procedure for the machine recognition of words and sentences is proposed, and a preliminary implementation of that procedure is described. The computer program attempts to estimate distinctive features information about some stops, fricatives, and vowels in multi-syllabic words and short sentences without reference to a lexicon, and independent of a speaker. Average correct recognition scores of 92% to 95% were obtained for five adult male speakers and three different vocabularies ranging from 60 short sentences to 100 multi-syllabic words. Only one of the five speakers was used to develop the recognition program; the other four were completely new to the system. Author

N73-23148 California Univ., Santa Barbara. Computer Research Lab.
AN INTERACTIVE SYSTEM FOR THE ANALYSIS OF CONNECTED SPEECH
David L. Retz and Roger C. Wood *In* IEEE The 1972 Conf. on Speech Commun. and Process. 22 Feb. 1972 p 117-120 refs (For availability see N73-23119 14-07)
(Contract DAHC04-71-C)

Numerous and varied signal processing techniques were developed to decode information contained in the acoustic waveform of human speech. Systems were demonstrated which exhibit speech recognition ability; however, many cues to speech perception remain hidden. This fact has motivated the development of a minicomputer on-line system which is a highly useful tool in signal analysis. This interactive system enables a user to graphically explore the nature and variability of acoustical characteristics in speech. The system is currently being applied to wave-function analysis of connected speech, and measurement of speaker dependent feature variations. Author

N73-23149 Purdue Univ., Lafayette, Ind.
A SYNTHETIC APPROACH TO THE RECOGNITION OF LIQUIDS AND GLIDES
R. Newman, K. S. Fu, and K.-P. Li *In* IEEE The 1972 Conf. on Speech Commun. and Process. 22 Feb. 1972 p 121-124 refs (For availability see N73-23119 14-07)
(Contract F19628-69-C-0157)

A study was made of the liquids and glides (l, r, w, y) with the objective of discrimination among them in an automatic recognition system. Spectral time samples were selected from digital spectrograms of isolated bisyllabic utterances spoken by two male and two female talkers. Frequency dimensionality reduction was achieved using statistical principal-component analysis. The sequencies of reduced time samples were subsequently time-smoothed and transformed to string representations. Based on the set of strings for each phoneme, syntactic recognition algorithms were applied. Recognition results are discussed. Author

N73-23150 Royal Inst. of Tech., Stockholm (Sweden).
A PHONETIC APPROACH TO ASR
Ulf Stalhammar and Inger Karlsson *In* IEEE The 1972 Conf. on Speech Commun. and Process. 22 Feb. 1972 p 125-128 (For availability see N73-23119 14-07)

Speaker variabilities in terms of speech wave parameters were evaluated for automatic speech recognition. The variabilities were mirrored in various acoustic and physiological domains, and related to sex, age, and individual factors. Speaker variability of segment durations are especially large in initial nasal consonants and in /t/. The maximal intensity of the consonant /t/ varies within a 40 db range. This was the most speaker sensitive measure. Group means of formant frequencies and voice fundamental frequencies were found to conform with established data. The continuity and overlapping of male, female, and female children data were especially apparent. Various degrees of diphthongization of the Swedish /i:/ pronounced (ij) are discussed. Extreme subjects produce an almost complete closure. Data also include /m/, /n/, /l/, and /r/ distributions. Author

N73-23151 Queens Univ., Belfast (Northern Ireland).
USES AND LIMITATIONS OF FUNDAMENTAL MODELS
M. P. Haggard *In* IEEE The 1972 Conf. on Speech Commun. and Process. 22 Feb. 1972 p 129-130 (For availability see N73-23119 14-07)

The reasons are given for engaging in the modelling of speech at a fundamental level as a method of speech synthesis. The fundamentality of a model is treated as a highly relevant concept. Contrast is made chiefly of methods for synthesis of speech operating upon articulatory parameters, and representing the control of the articulators with methods based upon operations, such as interpolations, solely in the acoustical domain. The contrast is between a fairly basic underlying, illuminating representation of speech. Author

N73-23152 Massachusetts Inst. of Tech., Cambridge. Research Lab. of Electronics.
ACOUSTIC THEORY OF THERMAL ANALOG SPEECH SYNTHESIS
Dennis H. Klatt *In* IEEE The 1972 Conf. on Speech Commun. and Process. 22 Feb. 1972 p 131-135 refs (For availability see N73-23119 14-07)
(Contract F19628-69-C-0044; Grant NS04332-09)

A detailed acoustic theory of speech production is formulated, and several refinements are proposed. This accumulated knowledge and the recent advances in digital signal processing technology are used to define a new terminal-analog speech synthesizer configuration. The synthesizer attempts to model the characteristics of the various sound sources of speech more accurately, and models the vocal-tract transfer function for fricatives by a novel circuit involving a set of switches. This

results in a simple control strategy for the synthesis of fricatives and plosive bursts. Author

N73-23153 Tohoku Univ., Sendai (Japan). Research Inst. of Electrical Communication.
SPEECH SYNTHESIS BY CONTROL OF NEUROPHYSIOLOGICAL PARAMETERS
Shizuo Hiki, Katsuyuki Niyada, and Juro Oizumi *In* IEEE The 1972 Conf. on Speech Commun. and Process. 22 Feb. 1972 p 136-139 refs (For availability see N73-23119 14-07)

In order to relate linguistic units to acoustical events in terms of neurophysiological parameters, a model of speech production mechanism is studied which is based on the anatomical structures and physiological natures of the articulatory organs. Author

N73-23154 Tokyo Univ. (Japan). Engineering Research Inst.
A GENERATIVE MODEL FOR THE PROSODY OF CONNECTED SPEECH IN JAPANESE
Hiroya Fujisaki and Hiroshi Sudo *In* IEEE The 1972 Conf. on Speech Commun. and Process. 22 Feb. 1972 p 140-143 refs (For availability see N73-23119 14-07)

The pitch contour of connected speech in Japanese is shown to be the response of mechanisms of glottal oscillation to a set of binary commands for the actualization of prosodic features. Presentation is made of definitions of basic units of prosody in Japanese, along with formulations of the processes of deriving these commands for voicing and accent from the surface structure of a sentence as probabilistic and deterministic automata. These formulations, combined with a model for the mechanisms of glottal control previously proposed, constitute a generative model for the prosodic pitch contour of Japanese, whose validity is demonstrated by analysis-by-synthesis of measured pitch contours. Author

N73-23155 California Univ., Berkeley. Phonology Lab.
THE REGULATION OF TIMING IN SPEECH
John J. Ohala *In* IEEE The 1972 Conf. on Speech Commun. and Process. 22 Feb. 1972 p 144-147 refs Sponsored by NSF (For availability see N73-23119 14-07)

Various hypotheses are offered for the underlying principles for the regulation of timing in speech: (1) speech consists of isochronic units; (2) speech units, though not isochronic, are executed in an open-loop fashion according to a pre-set time schedule; and (3) speech timing is not pre-programmed but is determined simply by executing one speech unit after another. Experimental results provide no support for (1) and the arguments in the literature offered in support of (2) are found to be inconclusive. The direction of future research is suggested. Author

N73-23156 Joint Speech Research Unit, Ruislip (England).
THE INFLUENCE OF GLOTTAL WAVEFORM ON THE NATURALNESS OF SPEECH FROM A PARALLEL-FORMANT SYNTHESIZER
J. N. Holmes *In* IEEE The 1972 Conf. on Speech Commun. and Process. 22 Feb. 1972 p 148-151 refs (For availability see N73-23119 14-07)

A computer-simulated parallel-formant synthesizer was used to copy short samples of human speech. It is possible to make the synthetic speech almost indistinguishable from the natural in spectrum, in waveform, and by listening, provided the synthetic glottal pulse is derived by inverse filtering from a typical natural vowel from the same talker. Various other pulse shapes were tried, such as the combination of cosine segments suggested by various workers as a close approximation to human glottal pulses. For producing speech acceptable as natural, none of these idealized pulse shapes was as successful as those derived by inverse filtering. Author

N73-23157 Bell Telephone Labs., Inc., Murray Hill, N.J.
SPEECH SYNTHESIS WITH THE AID OF A RECURSIVE FILTER APPROXIMATING THE TRANSFER FUNCTION OF THE NASALIZED VOCAL TRACT
Paul Mermelstein *In* IEEE The 1972 Conf. on Speech Commun. and Process. 22 Feb. 1972 p 152-156 refs (For availability see N73-23119 14-07)

The nasalized vocal tract is modelled as a transmission line with a side branch. Its transfer function may be determined from the vocal tract cross-sectional area and the degree of opening to the sidebranch. Auditory evaluation shows that this transfer function may further be approximated in terms of an all-pole network, the use of which represents a substantial saving in signal generation time. Author

N73-23158 McMaster Univ., Hamilton (Ontario). Dept. of Electrical Engineering.
SPEECH SYNTHESIS USING THE HADAMARD-WALSH TRANSFORM
Y. Y. Shum and A. R. Elliott *In* IEEE The 1972 Conf. on Speech Commun. and Process. 22 Feb. 1972 p 156-161 refs (For availability see N73-23119 14-07)

Efficient algorithms to compute both the Hadamard and Walsh discrete transforms, and their inverse, were developed for the speech research described in this paper. A non-real-time signal processing technique was implemented on a CDC 1700 computer system for speech analysis and synthesis. The results of using 8 (or 4) dominant Hadamard coefficients to reconstruct the original speech are presented. A digital system that can duplicate the algorithms to handle speech analysis, synthesis, or both, in real-time, is proposed. Author

N73-23159 McMaster Univ., Hamilton (Ontario).
A DIGITALLY CONTROLLED SPEECH SYNTHESIZER
W. O. Brown (Bell-Northern Res., Ottawa) and A. R. Elliott *In* IEEE The 1972 Conf. on Speech Commun. and Process. 22 Feb. 1972 p 162-165 refs (For availability see N73-23119 14-07)

The use of the orthogonal Walsh and Hadamard transforms has shown promise in reducing the bit rate for speech communication. This paper describes a unique digital apparatus which accepts as an input up to 8 dominant terms (in either the Walsh or Hadamard domains) of a transformed speech signal. Using a programmable Walsh (or Hadamard) function generator, a rate multiplier, and serial multiplexing, the device automatically resynthesizes the waveform described by the coefficients. The unit is entirely digital except for one D/A converter, and is suitable for computer interfacing. Results of using the apparatus for speech synthesis are discussed. Author

N73-23160 Carleton Univ., Ottawa (Ontario).
REAL-TIME SOFTWARE SPEECH SYNTHESIS
L. Robert Morris and Jean-Pierre Paillet *In* IEEE The 1972 Conf. on Speech Commun. and Process. 22 Feb. 1972 p 166-169 refs (For availability see N73-23119 14-07)

A procedure is described for realizing real-time synthesis of 4 KHz speech on a small or medium size computer. Author

N73-23161 Tracor, Inc., Austin, Tex.
DIAGNOSTIC EVALUATION OF INTELLIGIBILITY IN PRESENT DAY DIGITAL VOCODERS
William D. Voiers and Caldwell P. Smith (Data Sci. Lab., L. G. Hanscom Field, Mass.) *In* IEEE The 1972 Conf. on Speech Commun. and Process. 22 Feb. 1972 p 170-174 refs (For availability see N73-23119 14-07)

Recordings of the Diagnostic Rhyme Test by six male speakers were used to evaluate the performance of a sample of digital vocoders, all operating in the neighborhood of 2400 bps. The results are compared to those of the 1967 survey, and to the case of noise masked speech. Specific strengths and weaknesses of the typical vocoder of 1972 are discussed. Author

N73-23162 North Carolina State Univ., Raleigh.
SUBJECTIVE EVALUATION OF DIFFERENTIAL PULSE CODE MODULATION USING THE SPEECH GOODNESS RATING SCALE
Craig B. Grether and Raymond W. Stroh *In* IEEE The 1972 Conf. on Speech Commun. and Process. 22 Feb. 1972 p 175-178 refs (For availability see N73-23119 14-07) (Contract F44620-70-C-0122)

The objectives of this investigation were twofold: (1) to demonstrate the utility of the nine-point Speech Goodness Rating scale as a method for scaling user opinion of speech quality; and (2) to use this method to determine optimum parameters for DPCM systems with bit rates from 25.6 to 51.2 kilobits/second. Fifteen DPCM and PCM systems were simulated on a digital computer. The parameters investigated included the tradeoff

between bandwidth and number of quantization levels, and the number of taps in the DPCM predictor network. A total of 248 ratings were obtained from 31 trained listeners for each of the systems under consideration. Author

N73-23163 Bell Telephone Labs., Inc., Holmdel, N.J.
A SUMMARY OF WORK TO DATE ON THE EPL, AN OBJECTIVE SPEECH LEVEL MEASURE
Paul T. Brady *In* IEEE The 1972 Conf. on Speech Commun. and Process. 22 Feb. 1972 p 179-182 refs (For availability see N73-23119 14-07)

The need for a better measure of speech level is described in terms of the high variability and uncertainties about presently used methods. Consideration of the form of the distribution of instantaneous speech voltages has led to the definition of a measure termed equivalent peak level (epl), which is objectively measurable, follows known changes in circuit loss, and is insensitive to changes in threshold settings. Recent empirical studies have explored the relationship of epl with speech power, threshold crossing, and peak clipping. The epl were used in subjective testing and automated to measure speech levels in telephone calls. Author

N73-23164 National Aviation Facilities Experimental Center, Atlantic City, N.J.
EFFECTS OF STIMULUS TIME INTERVAL, RESPONSE MODE AND TEST MATERIAL FOR INTELLIGIBILITY TESTING
Allen C. Busch and Donald Eldredge *In* IEEE The 1972 Conf. on Speech Commun. and Process. 22 Feb. 1972 p 183-186 ref (For availability see N73-23119 14-07)

An experiment was set up to test the effects of: (1) Test Material: the Modified Rhyme Test (MRT) and a 9-Choice Closed Response Set Nonsense Syllable Test; (2) Interstimulus Time Interval: 2.5 and 3.0 seconds for the MRT and 3.0 and 3.5 seconds for the 9-choice; (3) Response Mode: the subjects' response sets were (a) arranged in a block and marked with a pencil, (b) arranged in a line and marked with a pencil, and (c) arranged in a line and subject responded by pushing a button aligned in a row with the response which punched a paper tape for computer processing; and (4) Six Signal-to-Noise Ratio: +8, +4, 0, -4, -8, and -12 db. The results indicated a statistically significant effect due to the interstimulus time interval and signal/noise as main effects. Author

N73-23165 Northwestern Univ., Evanston, Ill. Auditory Research Labs.
INTELLIGIBILITY AND DISCRIMINATION TESTING WITH ADAPTIVE METHODOLOGY
Daniel L. Bode and Raymond Carhart *In* IEEE The 1972 Conf. on Speech Commun. and Process. 22 Feb. 1972 p 187-190 refs (For availability see N73-23119 14-07)

Background information is provided regarding a new approach to the measurement of monosyllabic speech communication: so-called adaptive, or sequential testing. Normal listeners were employed in the present studies for the purpose of specifying the normative characteristics of selected adaptive tests. Monaural testing in a white noise background was used in an effort to minimize nonrelevant variables. Knowing normal features of the test procedures, and the test stimuli, a tester can rationally extend the use of this tool for specific applications. Author

N73-23166 CBS Labs., Stamford, Conn.
ADVANTAGES OF EXPERIENCED LISTENERS IN INTELLIGIBILITY TESTING
Paul Milner *In* IEEE The 1972 Conf. on Speech Commun. and Process. 22 Feb. 1972 p 191-193 refs (For availability see N73-23119 14-07)

The use of a highly experienced, permanent panel of listeners has eliminated some of the variables of intelligibility testing, and minimized many of the other objections to such testing. Variables such as training time, learning, and personnel changes are no longer significant. In addition, the problems of individual listener variation, and less tangible questions of motivation and fatigue were minimized. Consequently, measurements with low statistical variation and high repeatability have resulted. Typically, less than 2% difference in intelligibility score resulted from identical conditions measured nine months apart. This high reliability was also noted in other psycho-acoustic experiments. Author

N73-23167 Massachusetts Inst. of Tech., Cambridge.
ON PHONETIC FEATURES
Morris Halle and Kenneth N. Stevens *In* IEEE The 1972 Conf. on Speech Commun. and Process. 22 Feb. 1972 p 194-197 refs Sponsored in part by AFCRL (For availability see N73-23119 14-07)
(Grants HD-00111; MH-13390; NS-04332)

A review is provided of the concept of distinctive features and to indicate the role that features play. The various kinds of evidence supporting the theory of distinctive features are described, including data from studies of speech production, speech acoustics, and phonology. An example of the use of such evidence in support of some proposed features relating to laryngeal activity is given. Author

N73-23168 Purdue Univ., Lafayette, Ind. School of Electrical Engineering.
AN APPROACH TO SYNTACTIC RECOGNITION WITHOUT PHONEMICS
Wayne A. Lea *In* IEEE The 1972 Conf. on Speech Commun. and Process. 22 Feb. 1972 p 198-201 refs (For availability see N73-23119 14-07)

Linguistic and perceptual arguments are made relative to speech recognition systems to the effect that syntactic hypotheses must be formed before phonemic segments are identified. Certain aspects of syntactic structure are determined directly from prosodic features. Contours of voice fundamental frequency and intensity are used to hypothesize syntactic features, such as boundaries between grammatical constituents, stress patterns, and associated syntactic categories. Segmental phonological data is then combined with syntactic hypotheses to fill in details of sound structure. Author

N73-23169 Case Western Reserve Univ., Cleveland, Ohio.
SPEECH PROCESSING MEMORY
R. J. Jarvella *In* IEEE The 1972 Conf. on Speech Commun. and Process. 22 Feb. 1972 p 202-205 refs (For availability see N73-23119 14-07)

A review is presented of short-term memory results obtained in a series of experiments in which adult listeners heard connected speech. These studies were all conducted using a procedure in which tests of immediate recall and recognition were given at staggered intervals in narrative stories and dialogues. Across listeners, these tests generally followed immediately after all members of a small set of grammatically related constructions, each embedded at the same points in the running discourse. In each experiment, what listeners were able to remember from the speech presented just before tests was modulated by its grammatical structure. This organization in memory is proposed to derive from psycholinguistic operations followed in decoding its meaning. Author

N73-23170 Royal Inst. of Tech., Stockholm (Sweden). Dept. of Speech Communication.
PERCEPTIVE EVALUATION OF SEGMENTAL CUES
Rolf Carlson, Bjoern Granstroem, and Stefan Pauli *In* IEEE The 1972 Conf. on Speech Commun. and Process. 22 Feb. 1972 p 206-209 refs (For availability see N73-23119 14-07)

A study is made of the parts of the acoustic signal displaying rapid changes and short durations. Tape splicing experiments with natural voiceless stops indicated a greater amount of absolute identity of the explosion than might be expected from earlier studies. This finding is taken into account in speech synthesis. The use of competing cues and selective manipulation of explosions provide a sensitive method of testing cues in identification tests. Author

N73-23171 Royal Inst. of Tech., Stockholm (Sweden). Dept. of Speech Communication.
STOPS AND CV SEGMENT DURATION
Inger Karlsson and Lennart Nord *In* IEEE The 1972 Conf. on Speech Commun. and Process. 22 Feb. 1972 p 210-213 refs (For availability see N73-23119 14-07)

A simple device for recording articulatory occlusion is described. It enables studies of differences in the timing of

phonatory and articulatory events in labial stops and rounded vowels. Durational measures of Swedish vowels and stops in polysyllabic structures are discussed with respect to the influence of stress, phonemic length, voicing position, and speaking rate. Word length is found to increase somewhat when voicing is replaced by voicelessness and also when /i/-vowels are replaced by /a/-vowels. The latter effect is less pronounced in voiceless stop context. Interaction and compensatory effects e.g. the relative invariance of VC elements, are discussed. Author

N73-23172 Tokyo Univ. (Japan). Research Inst. of Logopedics and Phoniatrics.
COMPUTATIONAL PROCESSING OF PALATOGRAPHIC PATTERNS
O. Fujimura, I. Fujii, and R. Kagaya (Tokyo Univ. of Foreign Studies) *In* IEEE The 1972 Conf. on Speech Commun. and Process. 22 Feb. 1973 p 214-217 refs (For availability see N73-23119 14-07)

The time courses of articulatory movements and their random variability were studied by recording palato-lingual contact patterns using a thin artificial palate with a number of electrodes embedded. The data were obtained for one subject for his 25 repeated utterances of a carrier sentence in which a nonsense Japanese word of the form /aCa/ was embedded. The consonant C was one of nine consonants characterized by tongue tip articulations. Quantitative results were obtained by recording, in real time, both the digitized palatal signals and analog speech waveforms and then processing the data in a small digital computer.
Author

N73-23173 Edinburgh Univ. (Scotland). Dept. of Psychology.
ORIENTATION TO SPEECH-LIKE SOUNDS
T. F. Myers, R. Zhukova (Academy of Sciences (USSR), Leningrad), and L. A. Chistovich (Academy of Sciences (USSR), Leningrad) *In* IEEE The 1972 Conf. on Speech Commun. and Process. 22 Feb. 1972 p 218-221 refs (For availability see N73-23119 14-07)

Four experiments are described in support of a model of speech processing which takes account of perceptual asymmetry. The vowel /a/ from a complex signal generator was presented binaurally, each ear channel being independently controlled for signal intensity and duration of a medial interruption (0-90 msecs), such that a fused percept: /a/, /ara/, /ala/ or /a/-/a/ occurred in the median plane or to the left or right of it. Analysis of identification threshold and lateralization of the percept as functions of both duration of the interruption and inter-aural intensity difference enabled the levels and operations of the model to be tested. Author

N73-23174 Louisiana State Univ., New Orleans. Kresge Hearing Research Lab.
DICHOTIC SIGNS OF THE RECOGNITION OF SPEECH ELEMENTS IN NORMALS, TEMPORAL LOBECTOMEES, AND HEMISPHERECTOMEES
Charles I. Berlin, Sena S. Lowe-Bell, Robert J. Porter, Jr., Harriet L. Berlin, and Carl L. Thompson *In* IEEE The 1972 Conf. on Speech Commun. and Process. 22 Feb. 1972 p 222-225 refs (For availability see N73-23119 14-07)
(Grant NS-07005)

When patients with hemispherectomies and temporal lobectomies listen to dichotic pairs of equal-intensity syllables, they identify the contralateral ear syllables poorly. A similar contralateral suppression is seen when the ipsilateral ear stimuli are vowels or signals acoustically similar to the syllables. Suppression occurs even if the ipsilateral ear stimuli are 20-40db weaker than the contralateral ear syllables. The amount of contralateral suppression may depend on whether the ipsilateral stimulus has properties which make it a potential candidate for a special kind of speech processing. Author

N73-23175 Perception Technology Corp., Winchester, Mass.
STATISTICAL THEORY OF SPEECH PERCEPTION
Hueseyin Yilmaz *In* IEEE The 1972 Conf. on Speech Commun. and Process. 22 Feb. 1972 p 226-229 refs (For availability see N73-23119 14-07)

A simple theory of speech perception, based on information measures and evolutionary adaptive arguments, covers many known facts in a convenient fashion. The results of many independent psychophysical and statistical experiments lead to perceptual patterning, adaptive transformations, phonemic categorization, and interphonemic transformations. Experiments with selective splicing, extended repetition, and frequency inversion are likewise accountable. The theory is part of a general theory of perception, and considers speech-nonspeech distinction itself as categorical. It suggests a large number of experiments and predicts many new effects which are yet to be tested. Author

N73-23176 City Univ. of New York. Graduate Div.
SENSORY AIDS FOR THE DEAF: AN OVERVIEW
H. Levitt *In* IEEE The 1972 Conf. on Speech Commun. and Process. 22 Feb. 1972 p 230-233 refs (For availability see N73-23119 14-07)

Sensory aids for the deaf are subdivided into two broad classes, aids for speech perception and aids for speech training. These subdivisions are not mutually exclusive and certain aids cover both categories. Author

N73-23177 Clarke School for the Deaf, Northampton, Mass.
SOME EXPERIMENTS ON THE CONTROL OF VOICE IN THE PROFOUNDLY DEAF USING A PITCH EXTRACTOR AND STORAGE OSCILLOSCOPE DISPLAY
Arthur Boothroyd *In* IEEE The 1972 Conf. on Speech Commun. and Process. 22 Feb. 1972 p 234-237 refs (For availability see N73-23119 14-07)

A visible pitch display is described. This extracts fundamental frequency by filtering, converts the approximate sine wave to a pulse train, and displays a quantity which approximates to the log of the inverse of the pulse interval as a function of time. In experiments with deaf children, the display is first used as a simple measure of voluntary pitch control. The results show this to be very poor, though there is a significant improvement with increasing age. In a second experiment, a group of children are taught to perform simple pitch control tasks. Learning, with retention, occurs, but the results obtained by a control group using traditional noninstrumental techniques are almost as good. A third study involved prolonged teaching with one student.
Author

N73-23178 Bolt, Beranek, and Newman, Inc., Cambridge, Mass.
AN EXPERIMENTAL COMPUTER-BASED SYSTEM OF SPEECH TRAINING AIDS FOR THE DEAF
R. S. Nickerson and K. N. Stevens (MIT) *In* IEEE The 1972 Conf. on Speech Commun. and Process. 22 Feb. 1972 p 238-241 (For availability see N73-23119 14-07)
(Contract OE-C-0-71-4670)

An experimental computer-based system of speech training aids for the deaf is described. The rationale for computer involvement is given. Several working displays are described, and plans for evaluation are discussed. Author

N73-23179 Royal Inst. of Tech., Stockholm (Sweden). Dept. of Speech Communication.
TACTUAL AND VISUAL LIPREADING AIDS
Janos Martony and Karl-Erik Spens *In* IEEE The 1972 Conf. on Speech Commun. and Process. 22 Feb. 1972 p 242-245 ref (For availability see N73-23119 14-07)

An experiment with a lipreading aid indicating voice/voiceless feature using the visual or tactile sense is described. The experiment shows the positive effect of the aids which is most prominent for the stops. Author

N73-23180 Royal Inst. of Tech., Stockholm (Sweden). Dept. of Speech Communication.
THE TRANSPOSER AS A LIPREADING AID
Karl-Erik Spens and Janos Martony *In* IEEE The 1972 Conf. on Speech Commun. and Process. 22 Feb. 1972 p 246-248 refs (For availability see N73-23119 14-07)

Improved indication of stops were found while using a transposer as a lipreading aid. Two types of aids are discussed; they are aids for speech production and speech perception. Graphs are also included on lipreading with various aids for words with: (1) voiceless fricatives; (2) voiced phonemes; (3) both voiceless fricatives and voiceless stops; and (4) voiceless stops.
J.A.M.

N73-23181 Royal Inst. of Tech., Stockholm (Sweden). Dept. of Speech Communication.
INTRAORAL PRESSURE IN THE SPEECH OF THE DEAF
Janos Martony and Jan Lindqvist *In* IEEE The 1972 Conf. on Speech Commun. and Process. 22 Feb. 1972 p 249-251 refs (For availability see N73-23119 14-07)

Intraoral pressure measurements show that deaf speakers often have too high pressure (2-3 times the normal value). This high intraoral pressure has the effect that the voice/voiceless distinction is nearly not existing in their speech. Corrections of incorrect stop-production with the help of an intraoral pressure detector are being studied. Author

N73-23182 Perception Technology Corp., Winchester, Mass.
THREE PARAMETER SPEECH DISPLAY
Leon A. Ferber *In* IEEE The 1972 Conf. on Speech Commun. and Process. 22 Feb. 1972 p 252-254 refs (For availability see N73-23119 14-07)

A unit displaying three basic parameters of speech is described. Phonemes, pitch, and loudness are displayed for the purpose of general speech training. These parameters are displayed on a common C.R.T. screen as independent functions of time. The spectral distribution of a phoneme determines its position on the screen. The display intensity is determined by, the pitch in the case of vowels and by loudness in the case of fricatives. The center of the screen is the resting point of the display, giving a 360 deg resolution. An automatic adaptation is implemented to give the same resolution of vowels for a wide range of speakers. Author

N73-23183 Naval Ordnance Lab., White Oak, Md.
A SPEECH DISPLAY SIMULATION SYSTEM
Bernard J. Nordmann, Jr. *In* IEEE The 1972 Conf. on Speech Commun. and Process. 22 Feb. 1972 p 255-258 refs (For availability see N73-23119 14-07)
(Contracts AT(11-1)-2118; DAAB07-67-C-0199)

A speech display simulation system using a CDC 1604 computer is described. Although the present simulator cannot process speech in real-time, it is capable of interactive operation with the operator using a library of prerecorded and digitized speech utterances. The simulator is the first stage in an investigation into the relative effectiveness of various types of speech displays for possible use as feedback devices for the deaf. As such, its primary goal was to be very flexible in the generation of various types of speech displays. Several of the simulated displays are described, including spectrographic, formant, and zero-crossing displays. Author

N73-23184 Western Electric Co., Inc., Columbus, Ohio.
THE DESIGN OF THE VISUAL VOCODER
Jerry L. Kisner and Herman R. Weed (Ohio State Univ.) *In* IEEE The 1972 Conf. on Speech Commun. and Process. 22 Feb. 1972 p 259-262 refs (For availability see N73-23119 14-07)

The visual vocoder was designed to aid the teaching of speech to the deaf. It provides and stores in real time a simplified spectrographic display of speech sounds. The capability and design of this instrument are discussed. Author

N73-23185 Ohio State Univ., Columbus. Bio-Medical Engineering Center.
EVALUATION OF THE VISUAL VOCODER IN SPEECH THERAPY
Sanford Reich and Herman R. Weed *In* IEEE The 1972 Conf. on Speech Commun. and Process. 22 Feb. 1972 p 263-265 refs (For availability see N73-23119 14-07)

Performance evaluation objectives were: (1) to determine the effectiveness of the visual vocoder to differentiate between phonemes for different speakers; (2) to evaluate the visual vocoder in the speech training of deaf children; and (3) to evaluate desired design changes in the unit. A quantitative analysis of the vowel and vowel-like phoneme patterns of the visual vocoder is used as a basis for experimental evaluation. Tests were carried out using two normal hearing adults and two deaf children. The results of the study demonstrate the basic utilization of the visual vocoder as an aid for the deaf and provide suggestions for numerous additional applications such as regular speech therapy, foreign language pronunciation, and music interpretation. Author

N73-23186 Maryland Univ., College Park. Biocommunications Lab.
TRANSIENT RESPONSES OF HEARING AIDS WITH COMPRESSION
Igor V. Nabelek *In* IEEE The 1972 Conf. on Speech Commun. and Process. 22 Feb. 1972 p 266-269 refs (For availability see N73-23119 14-07)

Transient responses for three hearing aids with compression (HAC) are presented. It is shown that each transient response is composed of two parts, and that in the second part a long lasting distortion can occur. Specification of this and other characteristics is recommended for HAC evaluation. Author

N73-23187 Georgia Univ., Athens.
THE EFFECTS OF FREQUENCY BANDWIDTH AND HARMONIC DISTORTION ON SPEECH INTELLIGIBILITY FOR NORMAL AND HEARING IMPAIRED SUBJECTS
William R. Ambrose *In* IEEE The 1972 Conf. on Speech Commun. and Process. 22 Feb. 1972 p 270-272 refs (For availability see N73-23119 14-07)

This study was designed to investigate the effects of frequency bandwidth and harmonic distortion on speech intelligibility for normal, conductively impaired, and sensori-neurally impaired subjects. Three conditions of bandpass filtering, 300-4800 Hz, 600-1200 Hz, and 1200-2400 Hz, and four levels of harmonic distortions, 0%, 5%, 10%, and 20% were investigated. The sensori-neural group gave speech intelligibility scores much below either the normal or conductive group at the 300-4800 Hz bandpass and at the 1200-2400 Hz bandpass; however, at the 600-1200 Hz bandpass, all three groups gave essentially the same scores. Author

N73-23188 Smith-Kettlewell Inst. of Visual Sciences, San Francisco, Calif.
AN ELECTROTACTILE SOUND DETECTOR FOR THE DEAF
Frank A. Saunders *In* IEEE The 1972 Conf. on Speech Commun. and Process. 22 Feb. 1972 p 273-274 refs (For availability see N73-23119 14-07)
(Grants RR-05566-08; NS-09714)

The electrotactile sound detector described here enables deaf persons to detect and localize sounds. Signals from bilateral microphones are converted to electrical pulses and displayed on the forehead; differences in intensity and in time-of-arrival permit the wearer to localize the source of a sound. Author

N73-23189 International Business Machines Corp., Research Triangle Park, N.C.
TWO SPEAKER VERIFICATION EXPERIMENTS
Subrata K. Das, William S. Mohn, Jr., Shirley S. Willett, and William D. Chapman *In* IEEE The 1972 Conf. on Speech Commun. and Process. 22 Feb. 1972 p 275-278 refs (For availability see N73-23119 14-07)

The experiments were conducted with utterances of a single phrase produced by several male and female speakers in an office environment. The effective bandwidth of the system was approximately 200 Hz to 3600 Hz. In one experiment, the object was to determine how effectively the speakers could be discriminated by examining their normal utterances. In the other experiment, an attempt was made to establish whether the speaker verification system was vulnerable to impostors who deliberately attempted to imitate other persons' voices. Author

N73-23190 Institute of Control Systems, Tbilisi (USSR).
ON THE PROBLEM OF AUTOMATIC IDENTIFICATION OF VOICES
G. S. Ramishvili *In* IEEE The 1972 Conf. on Speech Commun. and Process. 22 Feb. 1972 p 279-282 refs (For availability see N73-23119 14-07)

The construction of a combined system of identification of individual voices under the conditions of natural speech activity is discussed. According to this approach, the speech signal must be considered as a complex of different, simultaneously present, kinds of information. The regular dynamic system of relationship between them creates the specific character of individual voice. Author

N73-23191 Bell Telephone Labs., Inc., Murray Hill, N.J.
LISTENER PERFORMANCE IN SPEAKER VERIFICATION

TASKS
A. E. Rosenberg *In* IEEE The 1972 Conf. on Speech Commun. and Process. 22 Feb. 1972 p 283-286 refs (For availability see N73-23119 14-07)

The ability of listeners to perform some speaker verification tasks was measured experimentally and compared with the performance of an automatic system for speaker verification. A test presentation on the subjective experiments consists of a pair of utterances. One of these is drawn from the recordings of a group of speakers designated as customers, while the second utterance is either a distinct recording from the same customer or the recording of an imposter. Listeners must respond whether the utterances are from the same or different speakers. The impostor classes that were considered are casual impostors making no attempt to mimic customers, trained professional mimics, and an identical twin of a customer. Author

N73-23192 Centre National d'Etudes des Telecommunications, Lannion (France).
SPEAKER ADAPTATION TO AN AUTOMATIC SPEECH RECOGNITION SYSTEM
M. Cartier, J. Y. Gresser, J. J. Lucas, and M. Querre *In* IEEE The 1972 Conf. on Speech Commun. and Process. 22 Feb. 1972 p 287-290 refs (For availability see N73-23119 14-07)

An attempt to measure the human adaptation to a category of machines is decribed. A fixed hardware system, which extracts acoustic and phonetic features from continuous speech, is connected to a program identifying isolated words. A vocabulary of 18 words, mostly monosyllables, was chosen and pronounced 100 times by each speaker over a period of several weeks. A data analysis shows that if human adaptation exists, it is a very slow process. Author

N73-23193 Ohio State Univ., Columbus.
INTERACTIVE AUTOMATIC SPEECH SEGMENTATION
H. Hemami and Ilse Lehiste *In* IEEE The 1972 Conf. on Speech Commun. and Process. 22 Feb. 1972 p 291-294 refs (For availability see N73-23119 14-07)

A preliminary attempt to automatically segment repeated utterances of isolated words is described. A digital computer is utilized for the automatic segmentation of the word. The acceptance or rejection of the analysis of each word is achieved by interaction of an operator with the computer. The main advantages of this method are extraction of reliable statistical information, speed and ease of analysis, and possible adaptation of the segmentation program to a variety of different words. Author

N73-23194 Speech Communications Research Lab., Inc., Santa Barbara, Calif.
FORMANTS IN AUTOMATIC SPEECH RECOGNITION
David J. Broad *In* IEEE The 1972 Conf. on Speech Comm. and Process. 22 Feb. 1972 p 295-298 refs (For availability see N73-23119 14-07)
(Contract F44620-69-C-0078)

The definition of the physiological phone in terms of articulatory dynamics can be interpreted acoustically in terms of formant dynamics. Formant transition information can aid segmentation. Formant frequencies for repetitions of utterances by a single speaker display remarkable stability, while the speaker identity, phonetic type, and phonetic, prosodic, and linguistic contexts are sources of nonrandom variability that should be included in a complete acoustic phonetics of speech. Examples of formant-slope segmentation and considerations for identifying phonetic types are given. Author

N73-23195 Washington Univ., Seattle.
THE ROLE OF THE CEPSTRUM IN SPEECH RECOGNITION
Edward Strasbourger *In* IEEE The 1972 Conf. on Speech Commun. and Process. 22 Feb. 1972 p 299-302 refs (For availability see N73-23119 14-07)

Continuous speech can be represented in a compact digital form by using the low order terms of the cepstrum with the voicing period (if any) as gleaned from cepstrum higher order peaking. Using this compact form, a phoneme pattern recognizer and finder was constructed for the continuant phonemes. An inexpensive interactive system was built to perform the recognition from a microphone in real-time. A continuous speech recognition system is being designed for a spoken computer language, using the cepstrum phoneme recognizer. Speaker identification and language recognition, also using this approach, are being attempted. Author

N73-23196 Perception Technology Corp., Winchester, Mass.
A NEW TIME DOMAIN ANALYSIS TECHNIQUE FOR SPEECH RECOGNITION
Henry G. Kellett *In* IEEE The 1972 Conf. on Speech Comm. and Process. 22 Feb. 1972 p 303-306 refs (For availability see N73-23119 14-07)

An effect previously considered negligible may be the stumbling block to effective recognition strategies in the early stages of recognition. Once the problem is recognized, strategies for its avoidance become readily apparent. One such strategy is described, and implications in terms of various known problem areas are discussed. Author

N73-23197 Institute of Electrical and Electronics Engineers, New York.
RECOGNITION OF NATURAL AND OF ARTIFICIAL SPEECH (PHONOCODE)
Jean A. Dreyfus-Graf *In its* The 1972 Conf. on Speech Commun. and Process. 22 Feb. 1972 p 307-310 refs (For availability see N73-23119 14-07)

Double-logarithmic amplitude regulators (with double loops) simulate the specifically nonlinear functioning of the human ear. They separate the plosive phonemes from the others, the frequential analysis from the dynamic, and segment the phonemes. The linear analyses of the Fourier type, or others, can then be applied. Natural languages, such as French or English, are not suitable for the recognition of limited vocabularies, e.g. the ten digits from zero to nine, as they call for the separation of about thirty phonemes. It is preferable to develop phonetic codes (phonocodes) based on the internationally most distinct classes of phoneme. The SOTINA 1 phonocode is based on the 6 phonemes o, a, i, s, t, n. It reflects the visual simplicity of the digits 0, 1, 2,...9 and is based on the linguistic roots of Sanskrit. A comparison is established between the machines such as the phonetograph, which recognize natural speech, and those such as phono-decoders, which respond to artificial speech. A brief description is given. Author

N73-23198 Nippon Telegraph and Telephone Public Corp., Tokyo (Japan). Musashino Electrical Communication Lab.
SPEECH RECOGNITION BY INCOMPLETE LEARNING SAMPLES
Masaki Kohda and Shuzo Saito *In* IEEE The 1972 Conf. on Speech Commun. and Process. 22 Feb. 1972 p 311-314 refs (For availability see N73-23119 14-07)

The mechanical recognition system of spoken words by incomplete learning samples is decribed. From the incomplete learning samples, several reference patterns needed for the speech recognition are directly derived, and others are estimated on the base of the derived ones. Using both the derived and estimated reference patterns, the recognition is performed on speech input words. The four types of the estimation method of reference patterns are tested and compared in the viewpoint of the recognition error. Author

N73-23199 Bolt, Beranek, and Newman, Inc., Cambridge, Mass.
SENTENCE RECOGNITION FROM VISUAL EXAMINATION OF SPECTROGRAMS AND MACHINE-AIDED LEXICAL SEARCHING
D. H. Klatt and K. N. Stevens *In* IEEE The 1972 Conf. on Speech Commun. and Process. 22 Feb. 1972 p 315-318 refs (For availability see N73-23119 14-07)

Attempts are reported to recognize 19 spoken sentences (representing data from 5 talkers) by visual examination of spectrograms. An initial partial transcription in terms of phonetic features was performed. The transcription contained many errors and omissions: 10% of the segments were omitted, 17% were incorrectly transcribed and an additional 40% were transcribed only partially in terms of phonetic features. The transcription was used by the experimenters to initiate computerized scans of a 200-word lexicon. A majority of the search responses did not contain the correct word. However, following extended interactions with the computer, a word-recognition rate of 96%

was achieved by each investigator for the sentence material. Implications for automatic speech recognition are discussed.
Author

N73-23200 International Business Machines Corp., Research Triangle Park, N.C. Systems Development Div.
DERIVATION OF PHONETIC REPRESENTATION BY COMBINING STEADY-STATE AND TRANSEMIC CLASSIFICATION IN AUTOMATIC RECOGNITION OF CONTINUOUS SPEECH (ARCS)
C. C. Tappert and N. R. Dixon *In* IEEE The 1972 Conf. on Speech Commun. and Process. 22 Feb. 1972 p 319-321 (For availability see N73-23119 14-07)

A phonetic classification procedure is discussed which operates on acoustic speech data that have been automatically segmented on a preliminary basis. It is a dual procedure in that it performs steady-state classification at boundaries and dynamic classification of a subword-segment (transeme) type corresponding to the transition from one phonetic state to the next. First, steady-state and dynamic data are consolidated into a single phonetic description of speaker performance. Second, contextual (time-domain) methods are applied to obtain a more complete description, including the certainty with which segmentation and classification were performed (anchor points). Information is retained at the phonetic-class level through time-aligned, annotated segmentation indicators. This complete description serves as input to subsequent linguistic decoding. Preliminary results are presented and discussed.
Author

N73-23201 International Business Machines Corp., Research Triangle Park, N.C. Systems Development Div.
APPLICATION OF SEQUENTIAL DECODING FOR CONVERTING PHONETIC TO GRAPHEMIC REPRESENTATION IN AUTOMATIC RECOGNITION OF CONTINUOUS SPEECH (ARCS)
C. C. Tappert, N. R. Dixon, and A. S. Rabinowitz *In* IEEE The 1972 Conf. on Speech Commun. and Process. 22 Feb. 1972 p 322-326 refs Sponsored by AFSC (For availability see N73-23119 14-07)

Following segmentation and phonetic classification in ARCS, it is necessary to provide methods for linguistic decoding. A graph search procedure, based on the Fano algorithm, is used to convert machine-contaminated phonetic descriptions of speaker performance into standard orthography. The information utilized by the decoder consists of a syntax, a lexicon containing transcription variation for each word, and performance-based statistics from acoustic analysis. The latter contain information related to automatic segmentation and classification accuracy and certainty (anchor-point) data. A distinction is made between speaker- and machine-dependent corruption of phonetic input strings. Preliminary results are presented and discussed, together with some considerations for evaluation.
Author

N73-23202 Tohoku Univ., Sendai (Japan). Research Inst. of Electrical Communication.
AUTOMATIC RECOGNITION OF SPOKEN WORDS UTILIZING DICTIONARY AND PHONOLOGICAL RULE
Shozo Makino, Shuichi Itahashi, and Keniti Kido *In* IEEE The 1972 Conf. on Speech Commun. and Process. 22 Feb. 1972 p 327-330 refs (For availability see N73-23119 14-07)

A spoken word recognition system utilizing a word dictionary and phonological rule is described. In this system, nine distinctive features are extracted from a spoken word input. Segmentation is performed according to these features. Errors in the segmentation are corrected by applying the phoneme connecting rule. The input word is transformed into an input feature matrix. The comparison of this matrix with the standard one derived from the dictionary is performed in the feature (matrix) space. Another method of segmentation is also described in which the segmentation is performed according to the duration dictionary. The effectiveness of utilizing a word dictionary and phonological rule to the automatic spoken word recognition is made clear. Author

N73-23203 Stockholm Univ. (Sweden).
INTERACTION BETWEEN SEGMENTAL AND NONSEGMENTAL FACTORS IN SPEECH RECOGNITION
Bjoern Lindblom and Stig-Goeran Svensson *In* IEEE The 1972 Conf. on Speech Commun. and Process. 22 Feb. 1972 p 331-333 refs Prepared in cooperation with Royal Inst. of Technol., Sweden (For availability see N73-23119 14-07)

Linguistic redundancies which have not been explored were studied. It is shown that if information on the distribution of stressed and unstressed syllables and tonal accents is assumed to be given for an arbitrary utterance drawn from a limited but sizeable fragment of a grammar, a strategy can be formulated that drastically limits the choice among alternative grammatical interpretations and the identification of the phonetic segments of syllables to a reduced list of lexical and grammatical items. The recognition of speech from spectrograms is also discussed.
F.O.S.

N73-23204 Carnegie-Mellon Univ., Pittsburgh, Pa.
A MECHANISTIC MODEL OF SPEECH PERCEPTION
D. R. Reddy, L. D. Erman, and R. B. Neely *In* IEEE The 1972 Conf. on Speech Commun. and Process. 22 Feb. 1972 p 334-337 refs (For availability see N73-23119 14-07)
(Contract F44620-70-C-0107)

An alternative is proposed to motor theory, and analysis-by-synthesis models of speech perception with emphasis on efficient machine realization of the model. Our model can be characterized as a hypothesize-and-test model of perception. It consists of a small set of cooperating parallel processes, each of which is independently capable of decoding the incoming utterance. Each of these parallel processes has heuristics for generation and verification of hypotheses based on a semantic, syntactic or lexical representation of the language to be perceived. These processes are able to guide and/or reduce the search space of each other as various subparts of the utterance are recognized. Details of a recognition system which incorporates these ideas is presented.
Author

N73-23205 Lvov Astronomical Observatory (USSR).
HIERARCHICAL MODELS OF WORDS AND SENTENCES RECOGNITION
M. Derkach, R. Gumetsky, and L. Mishin *In* IEEE The 1972 Conf. on Speech Commun. and Process. 22 Feb. 1972 p 338-339 (For availability see N73-23119 14-07)

A hierarchically organized recognition system designed for a computer is described. The analysis of the spoken words starts from a parametric description converting the utterance into a dynamic spectrogram. Sequences of phoneme codes are used to build word-like syllables. The procedures of the recognizing algorithm are discussed.
F.O.S.

N73-23206 System Development Corp., Santa Monica, Calif.
A VOCAL DATA MANAGEMENT SYSTEM
Jeffrey Barnett *In* IEEE The 1972 Conf. on Speech Commun. and Process. 22 Feb. 1972 p 340-343 refs (For availability see N73-23119 14-07)
(Contract DAHC15-67-C-0149)

An implementation strategy for a vocal data management system (VDMS) is described. VDMS will accept connected speech of a language describable by 25 to 50 phrase equations and having a vocabulary of approximately 1000 words formed from about 100 data records. The strategy is based on the concept of predictive linguistic constraints (PLC). The present concepts of fixed directionality in parsing are replaced by a more generalized approach. To facilitate this flexibility, the system comprises a set of near-independent co-routines that are interconnected by a software bussing structure. The VDMS acoustic processors verify the predictions. Very loose matching criteria are used for locating the predicted words. Special attention is given to word segments that are experimentally determined to be most invariant.
Author

N73-23207 Michigan Univ., Ann Arbor. Phonetics Lab.
PROSODIC SIGNALS FOR PARENTHESES IN ALGEBRAIC EXPRESSIONS
Michael H. OMalley, Benay Dara-Abrams, and Dean R. Kloker *In* IEEE The 1972 Conf. on Speech Commun. and Process. 22 Feb. 1972 p 344-347 refs (For availability see N73-23119 14-07)

A study of the relationship between pauses and parentheses in algebraic expressions is reported. It was found that both naive and experienced subjects are very consistent in pausing when reading algebraic expressions. Rules were developed for inserting parentheses based on the location and relative duration of pauses.

Parentheses were added to 88% of the expressions correctly. An almost perfect correlation between perceived pause and measured silence was found. Author

N73-23208 Marquette Univ., Milwaukee, Wis.
PHONEME RECOGNITION OF THE CONTINUANTS IN CONNECTED ENGLISH SPEECH
Russell J. Niederjohn and Ian B. Thomas (Mass. Univ.) *In* IEEE The 1972 Conf. on Speech Commun. and Process. 22 Feb. 1972 p 348-351 refs (For availability see N73-23119 14-07)

A method of computer recognition of connected speech is described. Input to the system is assumed to consist of the twenty-four continuant phonemes in connected English speech. The system first categorizes each successive 20 msec segment of the input speech utterance as either voiced fricative, voiced nonfricative, unvoiced fricative or no-speech, utilizing a measure of the relative energy balance between low and high frequencies. Next, the recognition of each 20 msec segment is performed from a distribution of axis-crossing intervals for speech prefiltered such as to emphasize each formant frequency range. Segmentation is performed from the results of recognition of each 20 msec segment and from changes in categorization. Finally, the results of recognition of each 20 msec segment between each pair of segmentation boundaries are combined and the phonemic sound occurring most frequently is printed out. When the system is trained for a single speaker, results indicate: A correct categorization decision for about 97% of the input, a correct recognition for about 78% of the input, and an overall correct phoneme recognition for about 87% of the input phonemes. Author

N73-23209 Magnavox Co., Silver Spring, Md.
A COMPARISON OF VOICE CODING TECHNIQUES FOR A SATELLITE-BASED AIR TRAFFIC CONTROL SYSTEM
J. N. Birch *In* IEEE The 1972 Conf. on Speech Commun. and Process. 22 Feb. 1972 p 352-355 refs (For availability see N73-23119 14-07)

The results are summarized of a survey of voice coding and intelligibility tests for a satellite-based air traffic control system. There were two primary constraints imposed on the study. First, the RF bandwidth allocation for each transmission is 20 kHz or less, and second, voice coding techniques capable of providing usable communications at low values of carrier-to-noise density were emphasized. The words 'voice coding' apply to both analog and digital techniques. Candidate voice coding techniques were selected at the beginning of the study for their ability to provide adequate air traffic control communications over the range of carrier/noise density values from 40 db-Hz to 48 db-Hz while requiring an RF bandwidth of 20 kHz or less. Other considerations included size, weight, power requirements, reliability, availability, and multiplexing capabilities. Both domestic as well as foreign technologies were used in the survey study. Author

N73-23210 Naval Submarine Medical Center, Groton, Conn.
HELIUM-SPEECH PROCESSING: REPORT OF A WORKSHOP
Russell L. Sergeant and Thomas Murry *In* IEEE The 1972 Conf. on Speech Commun. and Process. 22 Feb. 1972 p 356-359 (For availability see N73-23119 14-07)

The proceedings are reported of an international workshop on the topic of processing helium-speech. Progress and future development toward reliable speech communication under hyperbaric helium-speech conditions are discussed. The workshop conclusions presented should help redirect research efforts in underwater voice communications. Author

N73-23211 Massachusetts Univ., Amherst. Dept. of Electrical Engineering.
INTELLIGIBILITY ENHANCEMENT THROUGH SPECTRAL WEIGHTING
Ian B. Thomas and William J. Ohley *In* IEEE The 1972 Conf. on Speech Commun. and Process. 22 Feb. 1972 p 360-362 refs (For availability see N73-23119 14-07)
(Grant NS-08306)

The enhancement of speech intelligibility through appropriate spectral weighting is discussed. Intelligibility measurements of speech in noise after passing the speech through a highpass filter are reported. The intelligibility of speech passed through an optimum filter is found to be much higher than that of unmodified speech for a long range of signal to noise ratios when both are presented at the same average sound pressure level. Results are compared with those obtained when clipping followed highpass filtering. Author

N73-23212 Communications Research Centre, Ottawa (Ontario).
AN EXPERIMENTAL STUDY OF THE EFFECT OF FILTERING AND COMPRESSION ON SPEECH PROBABILITY DISTRIBUTION
C. Loo *In* IEEE The 1972 Conf. on Speech Commun. and Process. 22 Feb. 1972 p 364-367 refs (For availability see N73-23119 14-07)

An experimental study of the probability density function of the instantaneous amplitude of speech is described. The effect of filtering and compression on the speech probability density function is shown to be relatively small. This is a useful result for the design of single voice channel per carrier communication systems. It is also found from this experiment that there is a 1% probability of exceeding a clipping level set 13 db above the rms level of filtered and compressed speech. Author

N73-23213 Imperial Coll. of Science and Technology, London (England). Dept. of Electrical Engineering.
DETERMINATION OF VOCAL TRACK AREA FUNCTIONS FROM A POLE DESCRIPTION OF SPEECH SPECTRA
R. E. Bogner and J. Rogers *In* IEEE The 1972 Conf. on Speech Commun. and Process. 22 Feb. 1972 p 368-371 refs (For availability see N73-23119 14-07)

How unique and consistent area functions for non-nasalized vowels can be synthesized from a knowledge of the magnitude of the transfer impedance of the vocal tract, together with some assumptions about the loading conditions at the lips are shown. This information is used to determine the input resistance at the glottis as a function of frequency. The input reactance follows by Hilbert transformation. Next the input-reflection coefficient in the frequency domain is calculated from the input impedance at the glottis and inverse Fourier transformed to yield the reflection impulse response. Author

N73-23214 Connecticut Univ., Storrs. Dept. of Electrical Engineering.
A METHOD FOR SPEECH ANALYSIS BY A WAVEFUNCTION REPRESENTATION
Bernard J. Carey and James A. Howard *In* IEEE The 1972 Conf. on Speech Commun. and Process. 22 Feb. 1972 p 372-375 refs Prepared in cooperation with Calif. Univ., Santa Barbara (For availability see N73-23119 14-07)

A three stage algorithm is presented for representing human speech by time ordered sets of Hanning Cosine Modulated (HCM) wavefunctions. A given HCM element is defined by a five parameter set (A,S,C,phi,F), and the analysis algorithm, which may be implemented on a small computer system, calculates the parameter sets which represent the domain behavior of the acoustic signal. These parameter sets provide a closed form solution to the acoustic signal which permits convenient extraction of features of interest relating to human speech. Author

N73-23215 Waterloo Univ. (Ontario).
AUTOMATIC FREQUENCY CONTROL FOR SSB SPEECH RECEPTION
J. V. Hanson and R. W. Wilson *In* IEEE The 1972 Conf. on Speech Commun. and Process. 22 Feb. 1972 p 376-379 refs Prepared in cooperation with Airtronics, Inc., Washington, D. C. (For availability see N73-23119 14-07)

A solution to the single-sideband (SSB) detection problem is offered. The system employs a local oscillator control signal produced by comparing fundamental pitch frequencies extracted during voiced periods from both the baseband signal and the SSB envelope. A computer simulation has indicated that a hardware system would perform quite well. This paper includes specifications for a hardware detection system based on these results. Author

N73-23216 Rhode Island Univ., Kingston. Dept. of Electrical Engineering.
AUTOMATIC FORMANT TRACKING AND SPEECH RECOGNITION
S. E. Levinson and D. W. Tufts *In* IEEE The 1972 Conf. on

Speech Commun. and Process. 22 Feb. 1972 p 380-383 refs (For availability see N73-23119 14-07)

Speech recognition for a limited vocabulary (e.g. the spoken digits zero through nine) is performed by extraction of formant information from a discrete spectrogram. The essential process of generating a spectrogram which displays formants unambiguously is based on four interrelated procedures for time, frequency, and intensity computations. Formant tracking can then be performed by a modified peak-picking technique having certain discriminatory capabilities. Recognition is achieved by means of linear threshold logic which identifies an utterance in terms of the geometric shape of the extracted formants. These procedures are incorporated in a general algorithm which may be implemented in a variety of ways (e.g. software or special purpose hardware) and appears to have advantages over some existing techniques. Author

N73-23217 Tohoku Univ., Sendai (Japan). Dept. of Electrical Engineering and Research Inst. of Electrical Communication.

MULTIDIMENSIONAL REPRESENTATION OF PERSONAL QUALITY OF VOWELS AND ITS ACOUSTICAL CORRELATES

Hiroshi Matsumoto, Shizuo Hiki, Toshio Sone, and Tadamoto Nimura *In* IEEE The 1972 Conf. on Speech Commun. and Process. 22 Feb. 1972 p 384-387 refs (For availability see N73-23119 14-07)

Personal quality of sustained vowels uttered by eight male talkers was represented multidimensionally in a psychological auditory space, by means of a multidimensional scaling procedure based on the perceptual confusion in talker discrimination tests. Physical properties of the vowels were analized in terms of elementary acoustical parameters such as formant frequencies, slope of glottal spectrum, mean fundamental frequency, and fluctuation of pitch period. Then the relations between those physical parameters and the personal quality of the vowels were quantitatively examined through multiple correlation and regression analyses. Author

N73-23218 Speech and Hearing Services of Framingham, Inc, Mass.

ULTRA-HIGH FREQUENCY COMPONENTS OF SPEECH

Norma P. Weinberg and J. Morris Weinberg *In* IEEE The 1972 Conf. on Speech Commun. and Process. 22 Feb. 1972 p 388-391 Prepared in cooperation with Block Eng., Inc., Cambridge, Mass. (For availability see N73-23119 14-07)

An examination is made of the reproducibility of high frequency spectral peaks and the extent to which they exist in a representative number of sound pattern groups (voiced and voiceless stop sounds and voiced and voiceless fricative sounds) in the frequency range from 10,000 to 100,000 Hz. It was assumed that high frequency speech spectra of voiced and voiceless stop and fricative sounds exist and are reproducible in the frequency range from 10,000 to 100,000 Hz. The independent variables were the voiced and voiceless stop and fricative sounds spoken into the microphone. The dependent variable was the high frequency spectra of the stop and fricative sound pattern groups. Author

N73-23219 Institute for Perception RVO-TNO, Soesterberg (Netherlands).

ENVELOPE SPECTRUM AND INTELLIGIBILITY OF SPEECH IN ENCLOSURES

T. Houtgast and H. J. M. Steeneken *In* IEEE The 1972 Conf. on Speech Commun. and Process. 22 Feb. 1972 p 392-395 (For availability see N73-23119 14-07)

Introduction is made of a physical description of running speech from which the disturbing effects of reverberation and interfering noise on speech intelligibility can easily be obtained. The description proposed is the power spectrum of the envelope, quantifying the intensity-time function within specific audio-frequency bands (octave bands). The envelope spectrum ranges from 0.25 to 25 Hz and can be measured by standard audio-frequency apparatus by applying a 200-fold acceleration procedure. The relevance of the approach is illustrated by comparing, for some simple conditions of reverberation and noise interferences, the envelope spectra and the intelligibility scores obtained with talkers and listeners. Author

N73-23220 Tohoku Univ., Sendai (Japan). Research Institute of Electrical Communnication.

SEGMENTATION AND CLASSIFICATION OF SPEECH BY USE OF LOW Q SINGLE-TUNED FILTERS

Keniti Kido, Hisayoshi Suzuki, and Hideki Kasuya *In* IEEE The 1972 Conf. on Speech Commun. and Process. 22 Feb. 1972 p 396-399 ref (For availability see N73-23119 14-07)

Analysis of speech sound by use of single-tuned filters with Q=6 and two methods of the processing of the analyzed sound are proposed. The filter bank is composed of 29 channels of single tuning circuitry. In one method only the peaks in the filter outputs (spectrum) are treated. In the other method, moments of the spectrum are treated. Some good results were obtained with both methods, which are employed simultaneously in the proposed recognition scheme. Author

N73-23221 Brueel and Kjaer A/S, Copenhagen (Denmark).

THREE-DIMENSIONAL OUTPUT FROM THIRD OCTAVE FREQUENCY ANALYSIS

O. Moller Sorenson *In* IEEE The 1972 Conf. on Speech Commun. and Process. 22 Feb. 1972 p 400-403 (For availability see N73-23119 14-07)

The Real-Time Third Octave Analyzer Type 3347 features a display as well as an analogue and digital read-out of the measured spectrum. These outputs of the 3347 are normally used to generate a hard copy of a spectrum, or a digital transfer of numbers which correspond to the levels in the different third octave bands. Each one of the spectra transferred from the 3347 represents information in two dimensions (frequency and amplitude), but if the time interval between recordings of several spectra is made constant, a time-axis is created. The spectra can be transferred to the memory of a small computer, and a plotter can provide the three-dimensional plot of the data field, representing the frequency and amplitude variations as a function of time. Author

N73-23222 Ecole Nationale Superieure d'Electronique et de Radioelectricite, Grenoble (France).

A SPECIAL SPEECH PROCESSOR

D. Degryse, J. P. Serignat, and R. Carre *In* IEEE The 1972 Conf. on Speech Commun. and Process. 22 Feb. 1972 p 404-407 refs (For availability see N73-23119 14-07)

The main features of the special speech processor are described in terms of structure and signal processing capabilities. The processor is associated with a PDP 11 and is expected to be able to perform signal processing operations with a speed approximately 20 times greater than modern conventional digital computers. Examples are provided as illustration. Author

N73-23223 Wayne State Univ., Detroit, Mich. Dept. of Electrical Engineering.

A NEAR REAL-TIME OPTICAL SOUND-SPECTROGRAPH

F. T. S. Yu *In* IEEE The 1972 Conf. on Speech Commun. and Process. 22 Feb. 1972 p 408-411 refs (For availability see N73-23119 14-07)

The theory of a large space bandwith signal analysis by means of a two-dimensional optical processor is presented and the synthesis of a near real time optical sound-spectrograph is discussed. In the current state-of-the-art, the realization of an optical sound-spectrograph is feasible. It is concluded that the optical sound-spectrograph may offer a broader frequency range of analysis and flexibility in spectrum data handling. The former may be important in ultrasonic signal analysis; the latter may be important in future research in automatic speech recognition, synthesis, and translation. Author

N73-23224 Philips Zentrallaboratorium G.m.b.H., Hamburg (West Germany). Forschungslab.

REAL-TIME VISIBLE SPEECH WITH ELECTROSTATIC RECORDING

U. Dibbern *In* IEEE The 1972 Conf. on Speech Commun. and Process. 22 Feb. 1972 p 412-415 refs (For availability see N73-23119 14-07)

An electrostatic matrix printer is arranged to give a hard copy of visible speech in real time for a maximum bandwidth of 5 kHz. First a fast computer is used to execute a FFT of the signal, but further processing is done by analog techniques in the recorder itself. The gray-scale is generated by printing in

random manner a certain part of the potential points of the printer. In order to obtain optimum contrast, the grayness energy dependency and the frequency response may be adjusted manually. Author

N73-23225 Kurume Univ. (Japan). Dept. of Otolaryngology.
REGULATORY MECHANISM OF VOICE IN SINGING (16 mm FILM)
Minoru Hirano *In* IEEE The 1972 Conf. of Speech Commun. and Process. 22 Feb. 1972 p 416-419 refs (For availability see N73-23119 14-07)

Regulatory mechanism of register, pitch, and intensity of voice was investigated. Film presents the results of electromyographic, aerodynamic, and high speed cinematographic studies with five professional singers chiefly related to the function of the phonatory organ, i.e. the larynx, which directly regulates the vocal parameters. Author

N73-23226 National Security Agency, Fort Meade, Md.
AN IMPROVED SOUND SPECTROGRAPH
James F. Murphy *In* IEEE The 1972 Conf. on Speech Commun. and Process. 22 Feb. 1972 p 420-422 (For availability see N73-23119 14-07)

The limitations of the sound spectrograph for speech analysis are discussed. The application of the fast Fourier transform and time compression and Analysis techniques for speech analysis is proposed. The data requirements and suitability of the methods are analyzed and the supporting equipment is described. Author

N73-23227 Radio Corp. of America, Princeton, N.J.
SYNTHESIS OF UNLIMITED VOCABULARY SPEECH USING A COMPUTER CONTROLLED CHANNEL VOCODER
W. H. Jamison, H. Blatter, and F. I. Zonis *In* IEEE The 1972 Conf. on Speech Commun. and Process. 22 Feb. 1972 p 423-426 (For availability see N73-23119 14-07)

An experimental computer controlled voice response system has been developed. The VRU synthesizes unlimited vocabulary English speech from a stored dictionary of 550 vqcoded speech elements containing phonemes, syblets and syllables. Elements are assembled into words by special joining subroutines which smooth transitions at element boundaries and insert standard pitch contours. Elements are accessed from the computer using a phonetic alphabet developed for use with an RCA 70/752 video data terminal, and a specially designed hardware interface. The retrieved element data operates on the synthesizer section of a 2400 bit per second channel vocoder to produce an output speech signal. Author

N73-23228 Nippon Electric Co. Ltd., Kawasaki (Japan). Central Research Labs.
A TERMINAL ANALOG SPEECH SYNTHESIZER
Kazuo Ochiai and Takashi Araseki *In* IEEE The 1972 Conf. on Speech Commun. and Process. 22 Feb. 1972 p 427-430 refs (For availability see N73-23119 14-07)

A terminal analog speech synthesizer by use of analog circuits as main components was designed from various practical points of view. A serial-parallel type was proposed to improve signal to noise characteristics in the serial type without increase in the number of control parameters. Digital pulse width modulation and digital pulse number modulation techniques were introduced to enhance stability and accuracy in a variable resonator and a buzz generator respectively. The PNM method was also favorably utilized to incorporate the dynamic change in the glottal pulse wave form in accordance with pitch frequency into the buzz generator. Author

N73-23229 Centre National d'Etudes des Telecommunications, Lannion (France).
AN AUDIO RESPONSE UNIT FOR TELEPHONE NEEDS
Jacques Genin *In* IEEE The 1972 Conf. on Speech Commun. and Process. 22 Feb. 1972 p 431-433 refs (For availability see N73-23119 14-07)

An audio response unit has been built which synthesizes messages composed of a stable sentence and any number from 0 to 999,999. The method used is synthesis by concatenation of words and automatic corrections on pitch and rhythm are used to improve naturalness and intelligibility. The synthesizer is a part of a channel vocoder. This audio response unit is to be used in a telephone exchange to answer tax inquiries from the subscribers. Larger applications using touch-tone telephone as data input device are under consideration. Author

N73-23230 Nippon Telegraph and Telephone Public Corp., Tokyo (Japan). Musashino Electrical Communication Lab.
ON THE OPTIMUM QUANTIZATION OF FEATURE PARAMETERS IN THE PARCOR SPEECH SYNTHESIZER
Fumitada Itakura and Shuzo Saito *In* IEEE The 1972 Conf. on Speech Commun. and Process. 22 Feb. 1972 p 434-437 refs (For availability see N73-23119 14-07)

A method of speech analysis and synthesis, in which the spectral features are expressed in terms of the partial autocorrelation (PARCOR) coefficients is discussed. A technique for the optimum quantization of PARCOR coefficients to keep the spectrum quantization error miminum by allocating different bits to different PARCOR coefficients, using the dynamic programming algorithm is analyzed. Author

N73-23231 Bell Telephone Labs., Inc., Murray Hill, N.J.
DELTA MODULATION OF PITCH, FORMANT AND AMPLITUDE SIGNALS FOR THE SYNTHESIS OF VOICED SPEECH
N. S. Jayant *In* IEEE The 1972 Conf. on Speech Commun. and Process. 22 Feb. 1972 p 438-441 refs (For availability see N73-23119 14-07)

A computer simulation was performed to demonstrate the feasibility of delta modulation (DM) as a simple alternative to PCM for encoding the control signals of a voiced-speech synthesizer. Signals representing the time variations of pitch period, amplitude, and the first three formant frequencies were band-limited to 16 Hz, and quantized into a 1500 bits-per-second (BPS) format. Each of these signals was over-sampled at 100 Hz for delta-encoding, resulting in a representation at 500 BPS (an information rate utilized recently for an adequate PCM representation of the control signals). Author

N73-23232 Aerospace Medical Research Labs., Wright-Patterson AFB, Ohio. Neurophysiology Branch.
HARDWARE FOR A UNIQUE REAL-TIME ANALYSIS OF TRANSIENTS
J. Ryland Mundie, James C. Rock, John J. Godfrey, and Thomas J. Moore *In* IEEE The 1972 Conf. on Speech Commun. and Process. 22 Feb. 1972 p 442-445 (For availability see N73-23119 14-07)

A method of signal analysis based upon auditory function is presented. The method is well suited for analysis of transients and relates directly to speech features seen with more commonly used frequency spectrum analysis. A brief description of the hardware developed for this signal analysis technique is included. Author

N73-23233 Carleton Univ., Ottawa (Ontario).
THE ROLE OF ZERO CROSSINGS IN SPEECH RECOGNITION AND PROCESSING
L. Robert Morris *In* IEEE The 1972 Conf. on Speech Commun. and Process. 22 Feb. 1972 p 446-450 refs (For availability see N73-23119 14-07)

Experimental observations associated with clipped speech audition and the use of zero crossings in obtaining objective estimates of speech spectral features are reviewed in order to explicitly establish and interrelate exactly what is known and understood. Zero crossing-related speech phenomena are then examined from a viewpoint in which zeros (including zero-crossings) are regarded as informational attributes of signals. This method of signal specification, is used to realistically account for unexplained clipping phenomena, to justify the high intelligibility of clipped speech, and to clarify the value of zero crossings in estimating speech spectral parameters. Author

N73-23234 Utah Univ., Salt Lake City. Computer Science Div.
RECOVERY OF SINGING VOICE FROM NOISE BY SYNTHESIS
Neil J. Miller and Thomas G. Stockham, Jr. *In* IEEE The 1972 Conf. on Speech Commun. and Process. 22 Feb. 1972 p 451-452 refs (For availability see N73-23119 14-07)
(Contract F30602-70-C-0300; ARPA Order 829)

The application described here involves the reduction of noise

whose spectrum occupies predominantly the same frequency band as that of the signal. Specifically, the signal is a singing voice and the noise is wide band surface scratch and background music as found on an old acoustic disc recording. Since the surface scratch and background music are clearly recognized by human beings as being different from the singing voice and since these noises are not typical of the signals produced by the human speech producing mechanism, there might exist differences which could be exploited by a filtering system to separate the singing voice signal from the noise signal. Author

N73-23235# Deutsche Forschungs- und Versuchsanstalt fuer Luft- und Raumfahrt, Brunswick (West Germany). Inst. fuer Aerodynamik.

POSSIBILITIES OF AN AIRCRAFT TELEVISION SYSTEM [MOEGLICHKEITEN EINES FLUGZEUG-FERNSEH-SYSTEMS]

Armin Quast 1973 30 p refs In GERMAN: ENGLISH summary (DLR-MITT-73-09) Avail: NTIS HC $3.50; DFVLR, Porz, West Ger. 8,50 DM

The advantages of an aircraft television system over satellite transmission are discussed. A network of two aircraft circulating at a 20 km altitude and covering the Federal Republic of Germany territory is investigated. Its possible future applications, including geophysical and meteorological reconnaissance, use as a platform for astronomical observations and satellite experiments, are envisaged. ESRO

N73-23236# Naval Submarine Medical Center, Groton, Conn.

THE EFFECT OF ELECTROACOUSTIC CHARACTERISTICS OF LOW-FIDELITY CIRCUITRY UPON SPEECH INTELLIGIBILITY Interim Report

J. Smaldino and J. D. Harris 8 May 1972 36 p refs (MF51524004)

(AD-757326; NSMRL-707; IR-18) Avail: NTIS CSCL 17/2

Recorded speech tests were passed through 16 low-fidelity speech communication circuits, rated from good to poor, and listening panels underlined the key words heard. Mean scores among circuits (hearing aids) ranged from 53 to 75 per cent words correct. A total of 32 indices of electroacoustic characteristics was obtained or derived from measures of: transient, harmonic, intermodulation and frequency distortion; gain; and signal/noise ratio. Each index was correlated with speech intelligibility, and multiple correlations were derived for optimal prediction of speech intelligibility from a knowledge of the physical characteristics of any circuit. (Author Modified Abstract) GRA

N73-23237# Naval Postgraduate School, Monterey, Calif.

A PULSE POSITION MODULATED LASER COMMUNICATIONS SYSTEM M.S. Thesis

John St. Clair Craighill Dec. 1972 54 p refs

(AD-757258) Avail: NTIS CSCL 17/2

An optical communications system, suitable for simplex voice transmission is constructed, and demonstrated for straight line-of-sight, and for curved path operation using lenses and fiber optics. The system uses a pulsed gallium arsenide injection laser in the transmitter, operating at repetition frequency eight to fifteen kilohertz, and a p-i-n photodiode in the receiver. Pulse position modulation is used to transfer information as well as to trigger an avalanche transistor switch to drive the laser. Author (GRA)

N73-23238# Naval Electronics Lab. Center, San Diego, Calif.

WKB FIELDS PROGRAM FOR LOWER ELF Interim Report

Richard A. Pappert and Linda R. Shockey 2 Jan. 1973 51 p refs

(DNA Proj. NWER-HB-051)

(AD-757080; NELC-IR-731) Avail: NTIS CSCL 20/14

The report presents a Fortran IV WKB mode sum program developed for estimating round the world interference effects in the lower ELF band. The mode sum consists of the superposition of waves which travel over the long and short great circle paths to the observation point. WKB mode sum calculations are generated for the vertical electric field component, E(z), and the horizontal magnetic field component normal to the plane of propagation, H(y), excited by electric dipole sources of arbitrary elevation and orientation. Author (GRA)

N73-23239# Army Electronics Command, Fort Monmouth, N.J.

COMPARISON OF THE PERFORMANCE OF A LARGE AND A SMALL DELTA ANTENNA, AND A SPIRAL LOG PERIODIC ANTENNA

Richard J. DAccardi and Edwin L. Roswell, III Mar. 1973 111 p refs

(DA Proj. 1H6-62701-A-448)

(AD-757619; ECOM-4085) Avail: NTIS CSCL 09/5

Full-scale measurements were made of the elevation-plane gain patterns of in-house constructed fixed and transportable versions of the delta antenna. These antennas are primarily vertically looking radiators intended for use in ionospheric sounding. Measured patterns and theoretical considerations are presented along with details of the construction of both delta antennas and the transportable delta erection system. Included for comparison is the Granger Associates Model 798 Logarithmic Periodic Spiral Antenna. Author (GRA)

N73-23240# Army Electronics Command, Fort Monmouth, N.J.

BITERNARY FM SPECTRUM MEASUREMENTS

John M. DAndrea Nov. 1972 93 p refs

(DA Proj. 1H6-62701-A-448)

(AD-757139; ECOM-4050) Avail: NTIS CSCL 17/2

Since the spectrum characteristics of a transmitted signal effect the performance of radio communications systems, the occupied bandwidth was measured for both binary FM and biternary FM signals. Results of the biternary FM spectrum measurements are described and compared with binary FM. (Author Modified Abstract) GRA

N73-23241# Texas Univ., Austin. Applied Research Labs.

A DESIGN METHOD FOR UNEQUALLY SPACED SONAR ARRAYS

Michael L. Boyd 22 Jan. 1973 22 p refs

(Contract N00024-71-C-1266; SF11552002)

(AD-755481; ARL-TR-73-2) Avail: NTIS CSCL 17/1

A simplified design procedure for unequally spaced sonar arrays is presented in this report. The simplification is accomplished by employing a relation between the current in a given piezoelectric element and the area of the radiating surface of that element. This relation is used to adapt a standard amplitude shading technique to the spacing of the array. A 50 wavelengths long unshaded array, of 60 elements, is used to illustrate the design technique. The beam pattern of the resulting array (calculated using a standard summation formula for discrete radiators) exhibits side lobe levels of -21 db and a half-power beamwidth of 1.4 degree. Author (GRA)

N73-23242# Aerospace Corp., El Segundo, Calif.

ON RAINFALL AND SPACE DIVERSITY FOR MILLIMETER-WAVE EARTH-SATELLITE COMMUNICATIONS SYSTEMS Technical Report, Jul. 1971 - Jul. 1972

Earl E. Reber and D. V. McDonald 15 Mar. 1973 52 p refs

(Contract F04701-72-C-0073)

(AD-757506; TR-0073(3230-01)-1; SAMSO-TR-73-90) Avail: NTIS CSCL 17/2

Space diversity, i.e., the use of several widely spaced terminals, is examined as a means of reducing the probability of simultaneous rainfall in millimeter-wave earth-satellite communications systems. The concept of space diversity, both as a function of the distance between terminals and the number of terminals is examined on the basis of hourly rainfall data for the 10-yr period from 1 January 1961 through 31 December 1970. The probabilities of simultaneous rainfall occurring in a space diversity system are shown to be a systematic function of the spacing and number of terminals in the system. Author (GRA)

N73-23243# Aerospace Corp., El Segundo, Calif. Lab. Operations.

OPTICAL HETERODYNE SIGNAL POWER OBTAINED FROM FINITE-SIZED SOURCES OF RADIATION Technical Report, Jun. - Jul. 1972

30 Oct. 1972 41 p refs

(Contract F04701-72-C-0073)

(AD-756463; TR-0073(9230-10)-1; SAMSO-TR-73-39) Avail: NTIS CSCL 17/2

A general expression for the optical heterodyne signal power from a finite-sized radiation source is derived that is valid for

an arbitrary degree of coherence of the source. The signal power is given explicitly in terms of those variables that describe the source of radiation (e.g., total radiated power, brightness distribution, and source size). Incoherent and coherent sources are examined in detail, and analytic expressions are derived for various geometries of experimental interest. For a finite-sized incoherent source, a generalization of Siegman's results for an extended incoherent source is derived which states that the effective or capture area of the receiver integrated over its field of view is equal to the square of the optical wavelength. In addition, an analytic expression for the heterodyne signal power for a coherent Gaussian laser source and a Gaussian local oscillator is derived. Author (GRA)

N73-23244# Rhode Island Univ., Kingston. Dept. of Electrical Engineering.
DETECTION AND PROCESSING OF ELF (3-30Hz) NATURAL ELECTROMAGNETIC NOISE, PART 1 Final Report, 16 Nov. 1969 - 15 Nov. 1972
Thomas J. Keefe, Hellmuth Etzold, and Charles Polk 15 Jan. 1973 90 p refs
(Contract F19628-70-C-0090; AF Proj. 5631)
(AD-757482; Rept-4255/1-Pt-1; AFCRL-TR-73-0077) Avail: NTIS CSCL 20/14

Equipment is described which permits the continuous recording of natural electromagnetic noise in the 3 Hz to 30 Hz frequency band. Sensors for two orthogonal components of the horizontal magnetic field are two meter diameter, 44,000 turn air-core coils. The vertical electric field is detected either by a whip antenna or by an insulated metallic sphere located approximately ten meters above ground level. Dc operated preamplifiers are located at the sensors, and the amplified signal is transferred 600 feet to a building where it is further amplified, filtered and direct recorded continuously on magnetic tape. (Author Modified Abstract) GRA

N73-23245# Air Force Cambridge Research Labs., L. G. Hanscom Field, Mass.
PROPAGATION OF ELECTROMAGNETIC WAVES THROUGH TURBULENT MEDIA USING TRANSPORT THEORY
Ronald L. Fante 18 Dec. 1972 48 p refs
(AF Proj. 5635)
(AD-757491; AFCRL-72-0733; AFCRL-PSRP-519) Avail: NTIS CSCL 20/14

Transport methods have been employed to study the propagation of a narrow-angle electromagnetic beam through a turbulent medium. Results are presented for the mean-square angular divergence of the beam, cross section of the beam, and the power received by a planar aperture in the medium. The problem of back-scattered radiation is also considered and results are obtained which reduce, in the limit of zero true absorption, to previous results. Author (GRA)

N73-23246# Army Electronics Command, Fort Monmouth, N.J.
CIRCULAR SYMBOL AND VIDEO INSET GENERATOR FOR TELEVISION DISPLAYS
C. J. Capriglione and E. A. Karcher Mar. 1973 18 p refs
(DA Proj. 1F2-62202-A-A97)
(AD-757621; ECOM-4095) Avail: NTIS CSCL 17/2

The report describes the design of a circular symbol generator for use with television displays. These symbols can be used for presenting circles, ellipses or rings in the television raster. It can also be used for video insetting which enables a portion of two different video sources to be seen simultaneously one television screen. In this case, the inset would be circular or elliptical. The hardware is used in the Tactical Avionics System Simulator (TASS) in support of the Night Low Level Program. (Author Modified Abstract) GRA

N73-23247# Army Electronics Command, Fort Monmouth, N.J.
ATTITUDE LINE GENERATOR FOR TELEVISION DISPLAYS
C. J. Capriglione and E. A. Karcher Mar. 1973 26 p refs
(DA Proj. 1F2-62202-A-A97)
(AD-757620; ECOM-4094) Avail: NTIS CSCL 17/2

The report describes the design of an attitude line generator for use with aircraft-type television displays. The attitude line appears as a continuous line that can be pitched and rolled through 360 degrees. The attitude line is in effect a special symbol generated for a television display. The hardware is used in the Tactical Avionics System Simulator (TASS) in support of the Night Low Level Program. (Author Modified Abstract) GRA

N73-23248# Mitre Corp., Bedford, Mass.
RADIO WAVE PROPAGATION IN THE PRESENCE OF A TROPOSPHERIC DUCT
M. R. Dresp Dec. 1972 107 p refs
(Contract F19628-71-C-0002; AF Proj. 511A)
(AD-757198; MTR-2455; ESD-TR-72-323) Avail: NTIS CSCL 20/14

A full-wave solution was obtained for radio wave propagation in the presence of an elevated tropospheric layer. The tropospheric layer is modeled as a trilinear refractive index profile with a sufficient lapse rate so as to result in an elevated duct. The analytical solutions give the received signal level for air-to-air propagation paths at UHF, the corresponding signal fading level, and the space diversity distance to insure good quality reception. The analysis performed here can be applied to ionospheric propagation and to the underwater acoustic channel.
Author (GRA)

N73-23249# Naval Research Lab., Washington, D.C.
ADAPTATION OF THE NRL ACOUSTIC RESEARCH TANK FACILITY FOR EXPERIMENTS IN PARAMETRIC SONAR, WITH PRELIMINARY RESULTS Interim Report
Anthony I. Eller 29 Jan. 1973 25 p refs
(AD-756176; NRL-7513) Avail: NTIS CSCL 17/1

The NRL Acoustic Research Tank Facility, with its capability for obtaining numerical planar scans and graphic recordings of radiation patterns, has been adapted for use in parametric sonar studies. In a preliminary set of experiments, the facility was used to study difference-frequency radiation from an acoustic parametric source. The source used a USRD type E8 transducer, driven simultaneously at two frequencies close to the resonance frequency of 1.5 MHz. This report describes the experimental apparatus and illustrates the flexibility of the tank facility as a research tool in nonlinear acoustics. It also presents measured values of the difference-frequency sound pressure level and a sequence of radiation patterns that illustrates beam formation in the near field of the parametric source. Author (GRA)

N73-23250# General Electric Co., Daytona Beach, Fla. Apollo and Ground Systems.
SIMULATION OF A DIGITAL RADAR LANDMASS SIMULATOR Final Report
Roger M. Derby Jan. 1973 40 p refs
(Contract N61339-71-C-0207)
(AD-756219; H810002; NAVTRAEQUIPC-71-C-0207-2) Avail: NTIS CSCL 17/9

The report summarizes work in simulating the Digital Radar Landmass Simulator (DRLMS) for evaluation purposes. The software produced under this contract is run on a computing facility to generate simulated radar images on a radar display. The work done consisted of two parts: production of a data base and simulation of the hardware's processing of this data base. In development of the data base, the contractor compressed government-supplied data, in a grid format, to an edges representation. The edges are ridge and valley lines, in the case of terrain data, and reflectance boundaries for culture data. The algorithms used to achieve this representation are not to be construed as optimum. They are, however, vehicles for studying a technique and can be easily modified by the user if desired. GRA

N73-23251# Atmospheric Sciences Lab., White Sands Missile Range, N.Mex.
ACCURACY STUDY OF THE T-9 RADAR Research and Development Technical Report
Edward M. Darcy Mar. 1973 39 p
(DA Proj. 1T0-61102-B-53A)
(AD-757624; ECOM-5480) Avail: NTIS CSCL 17/9

In an effort to determine the accuracy of the T-9 radars, thirty jimspheres were released over a 4-day period in October 1971. These radars were used for determining winds to 10,000 feet above surface in the unguided rocket real-time impact prediction system. Each jimsphere was tracked simultaneously

by two T-9s and a cinetheodolite camera network. Using the cinetheodolites as a standard, mean differences and standard deviations were derived for each layer and for each profile. The results indicated that by using T-9 radars instead of the theodolite system, the standard deviation for the measured wind could be safely lowered. Author (GRA)

N73-23252# Systems Research Corp., Honolulu, Hawaii.
A POLLING MODIFICATION FOR BURST RANDOM ACCESS CHANNELS
Henry Liao 1972 10 p refs
(Contract N00014-70-C-0414)
(AD-756226) Avail: NTIS CSCL 17/2

In the paper the author analyzes a polling modification providing increased efficiency of a data communication channel employing the ALOHA burst random access method. The primary goal is to increase channel use of the random access mode by employing software control from the host computer without requiring any more hardware at the small terminal. The resulting improvement in channel use can be of benefit to the ARPANET Satellite system as well as the ALOHA system.
Author (GRA)

N73-23253# Defence Research Information Centre, Orpington (England).
INCREASE IN RESOLUTION POWER OF CAMERA TUBES
Ya. A. Ryftin and V. M. Myasnikov Jan. 1973 18 p refs
Transl. into ENGLISH from Tekhn. Kino i Televideniya (USSR), no. 8, Aug. 1972 p 37-42
(AD-756262; DRIC-Trans-3025; BR-30389) Avail: NTIS CSCL 17/2

The resolving power of the simplest, small-scale, widely used camera tubes (e.g. the Vidicon) is still insufficient even to realize the possibilities of 625-line scanning, while for cosmic, holographic and many other investigations tubes are needed which have a considerably higher resolution. The known means for increasing the resolving power comprise increasing the size of the photocathode target and decreasing the current and area of the switching beam, with the introduction of secondary electronic amplification of the video-signal. All of this finally leads to a sharp and, in most cases, inadmissible increase in the size and mass of the camera tube. The present work examines the possibility of increasing the resolving power without increasing the tube dimensions. GRA

N73-23254# Naval Electronics Lab. Center, San Diego, Calif.
INTEGRATED OPTICAL CIRCUITS Research and Development Report, 1 Apr. - 1 Oct. 1972
D. B. Hall 30 Jan. 1973 28 p refs
(ARPA Order 2158; NELC Proj. F215)
(AD-757342; NELC-TR-1861) Avail: NTIS CSCL 17/2

Work is reported on establishing the feasibility of integrated optics for use in high-capacity (multi-GHz) telecommunications and for implementing a militarily applicable, fiber-optic-transmission-line, multiterminal multiplexing system through low-loss coupling and modulation. More specifically, optical waveguiding in diffused-layer and heteroepitaxial thin-film semiconductor structures, both planar and three-dimensional, is demonstrated, as is electrooptic modulation in diffused-layer and heteroepitaxial thin-film semiconductor structures of high resistivity. In addition, optical propagation in fiber-optic waveguides is theoretically analyzed, and future areas of research and development (particularly pattern delineation and optical coupling) and theoretical analysis are outlined. Author (GRA)

N73-23255# Purdue Univ., Lafayette, Ind.
NETWORK CONTROL FOR THE AIR FORCE SECTIONS OF THE DEFENSE COMMUNICATION SYSTEM
Benjamin J. Leon and T.-C. Huang Dec. 1972 32 p refs
(Contract F30602-72-C-0105)
(AD-757551; RADC-TR-72-318) Avail: NTIS CSCL 17/2

The Defense Communication System is the basic worldwide communication system for the armed forces of the United States. At the present time, operation and maintenance of the system is done through technical control centers at each installation. Some years ago the suggestion was advanced that the technical control centers be automated. The study involved considerations of controlling the entire network so that users get the best service possible under various conditions of network performance. Author (GRA)

N73-23256# Signatron, Inc., Lexington, Mass.
DIGITAL TROPOSCATTER EXPERIMENTS Final Report, Mar. 1971 - Jul. 1972
Leonard Ehrman and James W. Graham Griffiss AFB, N. Y. RADC Jan. 1973 172 p refs
(Contract F30602-71-C-0177)
(AD-757553; SIG-A-125; RADC-TR-72-350) Avail: NTIS CSCL 17/2

Extensive measurements and predictions were made at 900 MHz to characterize the loss and multipath variations over the 168 mile Youngstown N. Y. to Verona N. Y. troposcatter link. Cumulative distributions of loss and multipath spread are in good agreement with predictions. Dual space and frequency diversity multipath analyses demonstrate that diversity receivers can use common timing provided the mean delays between paths are equalized. Time synchronization improvements made to a time-gated 3 Mbps coherent modem demonstrate that bit sync can be maintained reliably at signal levels well below those levels required for acceptable error rate and demultiplexer performance. (Author Modified Abstract) GRA

N73-23257# Alabama Univ., Huntsville.
MEASURE, CRITERIA AND PROCEDURE FOR TRACK AND SEARCH ALLOCATION Final Technical Report, Feb. 1972 - Feb. 1973
Robert J. Polge, Edward R. McKee, Jr., B. K. Bhagavan, and Roy D. Hays Feb. 1973 134 p refs
(Contract DAAH01-72-C-0585)
(AD-757172; UAH-RR-138) Avail: NTIS CSCL 17/9

A general procedure for radar resource allocation is presented. It requires the computation of the covariance matrix of the position estimates. Therefore, four estimation algorithms commonly used for track are evaluated and compared. A tracking measure applicable to the nontactical EAR system is defined. Finally, a schema for track and search allocation is presented. An example illustrates how the tracking measure is computed and used in the track and search algorithm. Author (GRA)

N73-23258# Massachusetts Inst. of Tech., Cambridge. Research Lab. of Electronics.
SPEECH AND PICTURE PROCESSING Semiannual Technical Report, 1 Sep. 1972 - 15 Jan. 1973
Alan V. Oppenheim 28 Feb. 1973 72 p refs
(Contract N00014-67-A-0204-0064; ARPA Order 1997)
(AD-757109) Avail: NTIS CSCL 09/4

During the second half of the contract year the program continued the following studies: speech analysis by linear prediction, reconstruction of multidimensional signals from projections, development of a high speed digital processor for speech synthesis, and the design of two-dimensional recursive digital filters. These projects are summarized, and reprints of available publications are appended. Author (GRA)

N73-23259# Naval Submarine Medical Research Lab., Groton, Conn.
PROCESSING HELIUM SPEECH: PROCEEDINGS OF A NAVY SPONSORED WORKSHOP, AUGUST 1971 Interim Report
Russell L. Sergeant and Thomas Murray 22 May 1972 81 p refs
(AD-757329; NSMRL-708; IR-10) Avail: NTIS CSCL 17/2

Progress and future developments toward relaible speech communication under hyperbaric helium-oxygen conditions were assessed. Concepts of helium-speech processing were advanced from straints allied to the unscrambler; that is, talker, listener, face mask and transducer. It was concluded that after a decade of research, the ability to correct hyperbaric helium-speech finally exists. Now a system that is small, inexpensive, rugged and reliable must be designed and incorporated into diving operations. (Author Modified Abstract) GRA

N73-23260# Pacific Missile Range, Point Mugu, Calif. Engineering Div.
METHOD OF MEASURING ENVIRONMENTAL FOCAL POINT SHIFT ERROR IN PARABOLIC DISH OF A METRIC

TRACKING RADAR
A. J. Garrett 1 Dec. 1972 50 p
(AD-758371; PMR-TP-72-11) Avail: NTIS CSCL 17/9

The study was conducted to explore the hypothesis that errors in radar installation and operation that are caused by certain mechanical deformations could be analyzed and corrected. The technique used was to place small optical mirrors at precise positions on a radar reflector. The sun images thus reflected on photographic paper make it possible to: (1) measure the actual surface deformation of a large radar reflector to an accuracy that the degree of conformance with specifications can be evaluated; and (2) to provide the data required to adjust the feedhorn focal point to an acceptably accurate position. The input of these measurements into radar calibration data before and after a tracking operation would greatly improve the accuracy of the radar system. Author (GRA)

N73-23261# Army Missile Command, Redstone Arsenal, Ala. Advanced Sensors Directorate.
EXPERIMENTAL ARRAY RADAR (EAR) TEST BED
William L. Low 24 Nov. 1972 33 p refs
(DA Proj. 1M2-62303-A-214)
(AD-758139; RE-72-18) Avail: NTIS CSCL 17/9

The report summarizes the background and the accomplishments of the Experimental Array Radar (EAR) exploratory development project. A test bed radar is described that features a crossed-beam electronically scanned antenna. This test bed is operational at low power levels and is located at the US Army Missile Command, Redstone Arsenal, Alabama. Each subsystem of the test bed is described along with appropriate photographs of completed equipment. Digital control and signal processing are used throughout the design. Pertinent performance characteristics of the nominally 20-kilometer detection range system are given. A preliminary assessment of applications and problems are cited. Author (GRA)

N73-23262# Texas Univ., Austin. Electronics Research Center.
AUTOMATIC RECOGNITION OF SPOKEN ENGLISH WORDS
Gary Lynn Hunt and C. L. Coates 28 Jul. 1972 79 p refs
(Contract F44620-71-C-0091; AF Proj. 4751)
(AD-757492; TR-131; AFOSR-72-1774TR) Avail: NTIS CSCL 17/2

The object of the research was the development and testing of techniques for use in the recognition of spoken words. A trainable pattern classifier to recognize a limited vocabulary of spoken words was implemented using these techniques. The words used were spoken into a microphone located on the operator console in the Hybrid Computing Facility. Speech samples were processed by a 31-channel bandpass filterbank before digitization. Training was accomplished by first segmenting each spoken word into three time sections and then performing clustering operations on these segments to derive a set of prototype segments, along with estimated a priori probabilities of occurrence for these prototypes. The system was trained first on a single speaker and later on a group of five speakers, using the digits/zero/through/nine/as a test vocabulary. Recognition rates were generally from 94 to 98% on new data by the speakers for which the system was trained. (Author Modified Abstract) GRA

N73-23263# SACLANT ASW Research Center, La Spezia (Italy).
STATISTICAL UNCERTAINTY OF ESTIMATING CORRELATION BETWEEN SIGNALS IN NOISE
Eugen O. Landeide 15 Dec. 1972 29 p refs
(AD-757459; SACLANTCEN-TM-185) Avail: NTIS CSCL 09/4

The memorandum considers the problem of estimating the correlation between two stationary random signals. The signals are known only for a finite interval of time and are corrupted by noise. Equations for the estimated correlation coefficient and the standard deviation of this coefficient are given. The application of the formulae requires that the signal has a large number of degrees of freedom within the time interval subject to analysis. Furthermore, the formulae for the standard deviation of the estimated correlation is valid only if this correlation is significantly different from zero. Author (GRA)

N73-23264# Wisconsin Univ., Madison.
OCEAN 1972: IEEE INTERNATIONAL CONFERENCE ON ENGINEERING IN THE OCEAN ENVIRONMENT (TRANSCRIBED RECORDING OF DISCUSSION FOLLOWING SESSION 1-E ON SANGUINE) Final Report
Ray J. King 12 Jan. 1973 21 p refs Conf. held at Newport, R. I., 13 Sep. 1972
(PB-213904/6) Avail: NTIS HC $3.00 CSCL 17B

A group discussion following Session 1-E of OCEAN 72 - IEEE International Conference on Engineering in the Ocean Environment is reported. Its purpose is to supplement and elaborate papers presented by the conference participants which were specifically devoted to the U.S. Navy's Extremely Low Frequency Communications System, Project Sanguine. It contains discussion by conference participants on antenna design, jamming, earth conductivity, and propagation models. Author (GRA)

N73-23265# Naval Postgraduate School, Monterey, Calif.
RADAR RANGE-GATED MTI (MOVING TARGET INDICATOR) PROCESSOR M.S. Thesis
Netjat Koral Dec. 1972 59 p refs
(AD-757259) Avail: NTIS CSCL 17/9

Twenty range-gated channels and the associated timing circuits were constructed for implementation of a moving-target indicator by range-gates and filters. Improvement over existing systems was accomplished by simplification in the range-gated channels. Elements of the system include both discrete and integrated circuits. A design objective was to achieve reliable and jitter-free gating pulses with timing flexibility. Performance of the system was tested in conjunction with the AN/UPS-1 air search radar. Author (GRA)

N73-23266# Naval Electronics Lab. Center, San Diego, Calif.
A PREDICTION SCHEME FOR THE LOWEST OBSERVED FREQUENCY (LOF) OF THE GUAM-NORTH WEST CAPE HF PROPAGATION PATH AND EIGHT OTHER PACIFIC PATHS Research and Development Report, Oct. 1970 - Oct. 1972
Max P. Bleiweiss 6 Dec. 1972 30 p refs
(AD-757343; NELC-TR-1851) Avail: NTIS CSCL 20/14

A simple method for predicting the lowest observed frequency (LOF) of hf propagation paths - LOF proportional to cos chi (sup 1/4), where chi is solar zenith angle - is presented. Predicted values of LOF in every case examined between midpath zenith angles of 5 and 85 are found to fall within the range of two standard deviations around the mean observed LOF. These findings - for the Guam to North West Cape (NWC), Australia, propagation path - are observed to match the results of a previous report on the Hawaii to California path. Predictions of the lowest useable frequency (LUF) provided by CNO are also compared with mean observed LOF values for the Guam-NWC path. Agreement is found to be good, though there are several exceptions. In addition, predictions are made for several other Pacific propagation paths. These are determined to fit the observed data well, with only one case of marked disagreement. It is concluded that the LOF prediction scheme is at least as good as the CNO LUF scheme, and less costly. Author (GRA)

N73-23267# Braddock, Dunn and McDonald, Inc., McLean, Va.
SIGNAL PROCESSING STUDY OF IMPULSE EXCITED OBJECTS IN SPACE Final Technical Report, Jun. 1971 - Sep. 1972
V. C. Martins and J. Vanmeter Jan. 1973 243 p refs
(Contract F30602-71-C-0158)
(AD-757220; BDM/W-TR72-094; RADC-TR-72-347) Avail: NTIS CSCL 17/9

The report contains the results of an investigation of optimum techniques for detecting and discriminating backscattered electromagnetic radiation associated with the impulse radar concept. The study reported herein is divided into three areas of investigation. The first of these is a study of backscatter in which several waveform variations for the sphere, rectangular plate, and thin rod geometries were determined mathematically tractable expressions for the scattered energy from typical geometrical shapes. The second part of this program involved the development of several optimal-like filter configurations based upon a knowledge of the characteristics of the waveforms of

interest. Finally, the geometry identification problem was investigated. GRA

N73-23268# Army Missile Command, Redstone Arsenal, Ala.
SOLID STATE MONOPULSE RECEIVER FOR THE EXPERIMENTAL ARRAY RADAR
William G. Briscoe and Edward A. Strickland Jan. 1973 67 p refs
(DA Proj. 1M2-62303-A-214)
(AD-757610; RE-73-1) Avail: NTIS CSCL 17/9

The receiver for the Experimental Array Radar is described. Design procedures, theory, construction, and test data are given. The receiver is a solid-state, superheterodyne, monopulse receiver. Four channels are required to process signals from two line phased array antennae. Three frequency conversion stages are used to convert C-band signals to bipolar video outputs. Sensitivity time control and automatic gain control are employed to increase receiver dynamic range. Computer-aided design techniques were used to design the stripline-balanced mixer and filter for the receiver front end. Author (GRA)

N73-23269# Army Missile Command, Redstone Arsenal, Ala.
THE STATE VARIABLE APPROACH TO THE ANALYSIS OF SELECTING DIGITAL MOVING TARGET INDICATORS FILTERS
Robert H. Fletcher, Jr. Feb. 1973 77 p refs
(DA Proj. 1M2-62303-A-214)
(AD-757611; RE-73-5) Avail: NTIS CSCL 17/9

A brief introduction to the digital Moving-Target-Indicator problem is presented along with a description of the conventional filters most commonly used for this purpose. The idea of initialization is then introduced for use with step scan radars, and the recursively implemented filter is proposed as a leading candidate for the Moving-Target-Indicator role. The essential features of the state variable approach are discussed and several useful relationships are developed. These expressions are then employed in the analysis of a number of filters, and some conclusions are drawn regarding the applicability of the state variable approach. Author (GRA)

N73-23270# Stanford Research Inst., Menlo Park, Calif.
SPEECH UNDERSTANDING RESEARCH Annual Technical Report, 4 Oct. 1971 - 2 Oct. 1972
Donald E. Walker Feb. 1973 62 p refs
(Contract DAHC04-72-C-0009; ARPA Order 1943; SRI Proj. 1526)
(AD-757049) Avail: NTIS CSCL 17/2

Progress is reported on a program of research on the analysis of continuous speech by computer. The goal is the development of a speech understanding system capable of engaging a human operator in a natural conversation about a specific problem domain. The approach being taken is distinctive in its use of syntactic and semantic processing to guide the acoustic analysis. (Author Modified Abstract) GRA

N73-23271# Systems Research Corp., Honolulu, Hawaii.
SYNCHRONOUS BURST RANDOM ACCESS CHANNELS
Henry Liao 1972 11 p refs
(Contract N00014-70-C-0414)
(AD-756227) Avail: NTIS CSCL 17/2

In the paper the author analyzes several modifications of the ALOHA random access channel by considering time synchronization among the users. The primary goal is to improve the random access channel use by using a simple clock in the host computer and in each remote terminal for synchronization. In the paper the author is interested in the mathematical analysis of different synchronous schemes rather than on the cost of operational mechanisms of the synchronization equipments. GRA

N73-23272# Naval Postgraduate School, Monterey, Calif.
A FEASIBILITY STUDY OF A HYBRID SECURE VOICE CODING PROCESSOR M.S. Thesis
John Gary Oehlenschlager Dec. 1972 22 p refs
(AD-756519) Avail: NTIS CSCL 17/2

An investigation of a proposed hybrid voice coding system proved the feasibility of such a system to provide a privacy voice channel with an acceptable degree of intelligibility. The proposed system is basically a voice inversion system employing a randomly generated carrier frequency for inversion. The random carrier frequency generator is controlled by a programmable, digital character generator. The hybrid system is readily adaptable to present military and civilian VHF/UHF voice communications systems at a relatively low cost and with a very minimum of equipment modification. Author (GRA)

N73-23273# Joint Publications Research Service, Arlington, Va.
STRUCTURAL PRINCIPLES AND PROSPECTS FOR THE CREATION OF NEW BROADCAST AND NATIONAL COMMUNICATIONS TELEVISION DURING 1971-1975
I. A. Rosselevich 4 May 1973 9 p Transl. into ENGLISH from Radiotekhnika (Moscow), no. 11, 1972
(JPRS-58928) Avail: NTIS HC $3.00

A state of the art review of the U.S.S.R. television industry is presented along with an assessment of the requirements and technology for the development of an advanced television network. Various topics discussed include: microminiaturization, communication satellites, cost effectiveness, utilization of computer technology, and possibilities for 3-D color transmission. Author

N73-23885 Northrop Corp., Palos Verdes Peninsula, Calif.
AUTOMATIC ACQUISITION AND TRACKING METHODS EMPLOYED IN THE JOINT SERVICES IN-FLIGHT DATA TRANSMISSION SYSTEM (JIFDATS)
T. N. Leiboff *In* AGARD Automation in Manned Aerospace Systems Mar. 1973 21 p (For availability see N73-23881 14-31)

N73-23978* Jet Propulsion Lab., Calif. Inst. of Tech., Pasadena.
ON THE FEASIBILITY OF EFFICIENT MULTIAMPLITUDE COMMUNICATION
J. G. Smith *In its* Quart. Tech. Rev., Vol. 2, No. 4 Jan. 1973 p 62-71 refs (For availability see N73-23970 14-34)
CSCL 17B

08 COMPUTERS

Includes computer operation and programming; and data processing. For applications, see specific categories. For related information see also: 19 Mathematics.

N73-23274# RAND Corp., Santa Monica, Calif.
VPACK: A FORTRAN-CALLABLE GRAPHICS PACKAGE FOR THE RAND VIDEO GRAPHIC SYSTEM
R. Lawrence Clark and Gabriel F. Groner Dec. 1972 53 p refs
(Grant CA-12369-02)
(R-1015-NIH) Avail: NTIS HC $4.75

VPACK is a package of subroutines that enable FORTRAN programs to communicate with the Rand Video Graphic System. The package comprises routines for building and transmitting pictures, for receiving input from the Rand Tablet and the console keyboard, and for producing hardcopy of displayed images. The VPACK routines perform relatively primitive functions. More complex functions can be created by combining calls to several VPACK routines in a FORTRAN subprogram. Author

N73-23275# Medical Biological Lab. RVO-TNO, Rijswijk (Netherlands).
COMPUTING PROGRESS IN THE MEDICAL BIOLOGICAL LABORATORY, 1970 - 1972
J. F. Anthoni, O. BrocadesZaalberg, P. H. M. Lohman, J. R. Mees, H. DeVroome, and M. Wijnans 29 Nov. 1972 41 p refs
(MBL-1972-4) Avail: NTIS HC $4.25

Progress in the computer effort at the medical biological laboratory is reported. Having acquired a PDP8/I computer in early 1970, the effort in adapting that machine to the needs of the various laboratory applications resulted in a set of programs. Author

N73-23276# Electrotechnical Lab., Tokyo (Japan).
A METHOD FOR QUANTITATIVE PRINT QUALITY EVALUATION OF A LARGE NUMBER OF DATA
Issei Yamasaki Jul. 1972 130 p refs In JAPANESE; ENGLISH summary
(Rept-731) Avail: NTIS HC $8.50

Quantitative evaluation of print quality is necessitated for evaluating the performance of optical character readers, and developing reliable optical character readers. An objective and mechanical, as well as efficient and quantitative method for evaluation of printed images is described. The value of similarity expressed by the cosine of the angle formed by two pattern-vectors is employed as the basis of the evaluation. The evaluation based upon the similarity demands the positioning and the coincidence of stroke-widths between the input pattern and the standard pattern. These two subjects have been studied theoretically and experimentally by using model data with artificial noises. The sampling interval of printed patterns, increment of stroke-widths prepared for a standard character, and estimation interval which estimates the relative position of true maximum similarity and its position are determined from the stand point of the feasibility of print quality measuring instruments. The usefulness of the method has been examined with a computer program using pseudo-data with artificial noises, and numerals of OCR-A font printed with a line printer. It is concluded that the print quality which has had to be examined by man can be evaluated quantitatively, objectively, and mechanically. Author

N73-23277# Deutsche Forschungs- und Versuchsanstalt fuer Luft- und Raumfahrt, Oberpfaffenhofen (West Germany).
INTRODUCTION TO SATELLITE DATA PROCESSING
B. Ebel, K. Wiegand, F. W. Bertram, B. Theile, F. Both, J. W. Muench, G. R. Pilkington, and F. Singer Feb. 1973 162 p refs In GERMAN; ENGLISH summary
(BMFT-FBW-73-04) Avail: NTIS HC $10.25, ZLDI Munich: 35,45 DM

The lectures give a comprehensive presentation of the procedures for satellite data processing from reception of the telemetry signal to plotting of the scientific results. Fundamental conceptions are illustrated by means of examples and personal experiences gained from data processing are communicated. Author

N73-23278# RAND Corp., Santa Monica, Calif.
SOME EXPLORATORY EXPERIENCE WITH EASY COMPUTER SYSTEMS
H. Sackman Feb. 1973 16 p refs Presented at Natl. Computer Conf., New York, 4-8 Jun. 1973
(P-4962) Avail: NTIS HC $3.00

Six examples are presented of allegedly easy computer systems with hopefully useful insights into why some succeeded while others failed, with emphasis on the extension of computer services to everyman. The examples range from interactive graphic systems to simple information retrieval services. The users vary from executive suite, to scientists, students, and the ghetto dweller. Reasons for failure range from culture shock to computer oversell; reasons for success range from faster and better solutions on the job to active community proselytizing. The conclusion is that there are no easy conclusions for easy systems. Author

N73-23279*# Stanford Research Inst., Menlo Park, Calif.
RESEARCH AND APPLICATIONS: ARTIFICIAL INTELLIGENCE Final Report, 8 Oct. 1970 - 7 Oct. 1971
B. Raphael, R. O. Duda, R. E. Fikes, P. E. Hart, N. J. Nilsson, P. W. Thorndyke, and B. M. Wilber Dec. 1971 86 p refs
(Contract NASw-2164; SRI Proj. 8973)
(NASA-CR-131991) Avail: NTIS HC $6.50 CSCL 09B

Research in the field of artificial intelligence is discussed. The focus of recent work has been the design, implementation, and integration of a completely new system for the control of a robot that plans, learns, and carries out tasks autonomously in a real laboratory environment. The computer implementation of low-level and intermediate-level actions; routines for automated vision; and the planning, generalization, and execution mechanisms are reported. A scenario that demonstrates the approximate capabilities of the current version of the entire robot system is presented. Author

N73-23280*# Stanford Univ., Calif. Dept. of Computer Science.
ON THE POWER OF PROGRAMMING FEATURES
Ashok K. Chandra and Zohar Manna Jan. 1973 32 p refs
(Contract NSR-05-020-500; ARPA Order 457)
(NASA-CR-131895; AD-757367; STAN-CS-73-333) Avail: NTIS HC $3.75 CSCL 09B

The authors consider the power of several programming features such as counters, pushdown stacks, queues, arrays, recursion and equality. In the study program schemas are used as the model for computation. The relations between the powers of these features is completely described by a comparison diagram. Author (GRA)

N73-23281# Science Applications, Inc., La Jolla, Calif.
SPECTRAL UNFOLDING: ITS MATHEMATICAL BASIS, IMPLEMENTATION AND APPLICATION WITH MAZE2 Final Report
Martin Sperling Oct. 1972 115 p refs
(Contract DNA001-72-C-0054; DNA Proj. NWED-AXAP)
(AD-755190; SAI-72-574-LJ; DNA-2990F) Avail: NTIS CSCL 09/2

A mathematical basis for spectral unfolding is provided by the formulation of an optimization function, W, consisting of the sum of a posteriori and a priori information. Nonquadratic optimization functions result in nonlinear unfoldings. A particular nonquadratic W is formulated for application to general purpose nuclear spectral unfolding, and it is optimized by an accelerated gradient technique, with separate handling of high and low frequency spectral components. The local variation of W about its minimum specifies the error band of the unfolded spectrum. Use of the MAZE2 code is described, the code is listed, and a test problem is given. One subroutine now requires a computer with a 36-bit word length. GRA

N73-23282# Computer Corp. of America, Cambridge, Mass.
NETWORK DATA HANDLING SYSTEM Semiannual Technical Report, 1 Aug. 1972 - 31 Jan. 1973
Thomas Marill 31 Jan. 1973 38 p ref
(Contract DAHC04-71-C-0011; ARPA Order 1731)
(AD-757686; AROD-9816-2-A) Avail: NTIS CSCL 09/2

The report describes the activities for the period 1 Aug 1972 - 31 Jan 1973. The activity on the project has centered on development of the first software release, initial system demonstration, coordination with potential users, and work on a global weather data base. Author (GRA)

N73-23283# SACLANT ASW Research Center, La Spezia (Italy).
THE SACLANTCEN SHIPBORNE COMPUTER ENVIRONMENTAL-DATA ACQUISITION SYSTEM. VOLUME 1: OBJECTIVES, DESIGN CRITERIA AND SYSTEM ORGANIZATION
Francesco Spina 1 Mar. 1973 19 p refs
(AD-757458; SACLANTCEN-SM-6-Vol-1) Avail: NTIS CSCL 09/2

An automatic environmental-data logging and computing system installed on board SACLANTCEN's research vessel is described. The initial specifications and the basic problems encountered in changing from a conventional automatic to a computerized system are discussed. The features of the computer at the heart of the whole system are examined. Despite its limitations the system has proved to be an efficient means of real-time environmental-data acquisition. Specific items of the system are described in other memoranda of the series. Author (GRA)

N73-23284# New York Univ., N.Y. Dept. of Electrical Engineering and Computer Science.
AUTOMATIC DATA PROCESSING TECHNIQUES FOR GRAPHIC DATA DISPLAY GENERATION AND ANALYSIS Interim Scientific Report, 1 Sep. 1971 - 31 Aug. 1972
H. Freeman 31 Aug. 1972 15 p refs
(Grant AF-AFOSR-1854-70; AF Proj. 9769)
(AD-757530; AFOSR-73-0480TR) Avail: NTIS CSCL 09/2

The report provides a brief summary of research progress during the period 1 September 1971 - 31 Aug. 1972. Research under this grant is concerned with computer graphics and image processing, especially scene analysis, and to a large extent represents a continuation of work started during the previous

year. A list of publications resulting from the research to date is included. (Author Modified Abstract) GRA

N73-23285# Illinois Univ., Urbana. Coordinated Science Lab.
THE CAPACITOR-COUPLED SHIFT REGISTER
Thomas Tar-fei Chen May 1972 123 p refs
(Contract DAAB07-67-C-0199; Grants NSF GJ-29981; NSF GJ-31765)
(AD-758310; R-563; UILU-ENG-72-2224) Avail: NTIS CSCL 09/2

A shift register is a device with a number of identical information cells connected in series. Under the control of clock pulses, information in each cell is shifted to the adjacent cell. One common construction of a shift register connects conventional clock controlled flip-flops in series. The research described in the thesis concerns a class of devices that can be used in shift registers and was initiated by the discovery of the charge transfer property in the cells of the Plasma Display Panel. By using the charges deposited on the glass wall to store the information and the charge transfer mechanism to transfer the information, the plasma cell array should be able to perform the function of a shift register. The principles of the Plasma Shift Register can also be demonstrated by a circuit with coupling capacitors and charge transfer elements. Feasibility has been demonstrated in both the plasma device and in a solid state device in which the charge transfer elements are transitors operating in the avalanche region. (Author Modified Abstract) GRA

N73-23286*# Illinois Univ., Urbana. Dept. of Computer Science.
ILLIAC 4 Final Report
15 Jan. 1973 12 p Sponsored in part by NASA
(Contract AF 30(602)-4144; ARPA Order 788)
(AD-757779; ILLIAC-IV-265) Avail: NTIS HC $3.00 CSCL 09/2

The document describes GLYPNIR updates, the status of the Parallel Assembler (Pandora), and provides a summary of administrative activities to date. It is submitted as the Final Report in lieu of the last quarterly technical report. Author (GRA)

N73-23064 Royal Air Force Inst. of Aviation Medicine, Farnborough (England).
HYBRID COMPUTING: A TECHNIQUE FOR THE IMMEDIATE ANALYSIS OF PHYSIOLOGICAL DATA
G. H. Byford *In* AGARD Current Status in Aerospace Med. Feb. 1973 4 p refs (For availability see N73-23057 14-04)

N73-23882 Massachusetts Inst. of Tech., Cambridge.
MAN'S ROLE IN INTEGRATED CONTROL AND INFORMATION MANAGEMENT SYSTEMS
J. L. Nevins and I. S. Johnson *In* AGARD Automation in Manned Aerospace Systems Mar. 1973 7 p refs (For availability see N73-23881 14-31)

N73-23891* National Aeronautics and Space Administration. Marshall Space Flight Center, Huntsville, Ala.
OPTIMUM SPACEBORNE COMPUTER SYSTEM DESIGN BY SIMULATION
T. Williams (Computer Sci. Corp., Huntsville, Ala.), H. Kerner, J. E. Weatherbee (Computer Sci. Corp., Huntsville, Ala.), D. S. Taylor (Computer Sci. Corp., Huntsville, Ala.), and B. Hodges *In* AGARD Automation in Manned Aerospace Systems Mar. 1973 12 p refs (For availability see N73-23881 14-31)
CSCL 09B

N73-23892 Consiglio Nazionale della Ricerche, Pisa (Italy). Ist. di Elaborazione dell Informazione.
EXTENSION OF SIMULA 67 FOR PROCESS CONTROL
Juliusz H. Kardasz *In* AGARD Automation in Manned Aerospace Systems Mar. 1973 13 p refs (For availability see N73-23881 14-31)
Copyright.

N73-23894 Selenia S.p.A., Rome (Italy).
A GENERAL PURPOSE COMPUTER FOR SPACEBORNE APPLICATIONS
S. Boesso and R. Camberale *In* AGARD Automation in Manned Aerospace Systems Mar. 1973 18 p (For availability see N73-23881 14-31)

N73-23900 Marconi-Elliott Avionic Systems Ltd., Rochester (England).
DEVELOPMENTS IN AIRCRAFT DIGITAL SYSTEMS
R. Ruggles and E. M. Scott *In* AGARD Automation in Manned Aerospace Systems Mar. 1973 11 p (For availability see N73-23881 14-31)

N73-23977* Jet Propulsion Lab., Calif. Inst. of Tech., Pasadena.
INFORMATION MANAGEMENT SYSTEM FOR THE CALIFORNIA STATE WATER RESOURCES CONTROL BOARD (SWRCB)
T. C. Heald and G. H. Redmann *In its* Quart. Tech. Rev., Vol. 2, No. 4 Jan. 1973 p 53-61 (For availability see N73-23970 14-34)
CSCL 09B

09 ELECTRONIC EQUIPMENT

Includes electronic test equipment and maintainability; component parts, e.g., electron tubes, tunnel diodes, transistors; integrated circuitry; microminiaturization. For basic research see: 10 Electronics. For related information see also: 07 Communications and 21 Navigation.

N73-23287# Physics Lab. RVO-TNO, The Hague (Netherlands).
MEASURED ELEMENT FACTOR OF A LINEAR ARRAY FOR VARIOUS WAVEGUIDE RADIATING ELEMENTS
J. Snieder Jan. 1973 46 p
(PhL-1973-1) Avail: NTIS HC $4.50

The elements factor from a linear array was measured. The distance between the elements, the size and shape of the aperture, and the frequency were varied. A pronounced dependence of the ratio of interelement distance and free space wavelength was observed and a pronounced independence was found between the size and the shape of the aperture. A partial filling of the waveguide with a dielectric material did not show any deviation from the case of an empty waveguide. The radiation in the E-plane as a function of the angle can roughly be predicted. Author

N73-23288# Physics Lab. RVO-TNO, The Hague (Netherlands).
THE INFLUENCE OF THE SHAPE OF FLARES ON THE ELEMENT FACTOR AND THE GAIN AS A FUNCTION OF SCAN ANGLE OF A 40 ELEMENT LINEAR ARRAY AT X-BAND
J. Snieder Mar. 1973 22 p
(PhL-1973-10) Avail: NTIS HC $3.25

It is reported that the change in gain with scan angle of an electronically steered linear phased array antenna can be altered with the shape of the flares of the array without changing the distance between the array elements. The measurement of the element factor proved to be a useful and simple method for this study. A reduction in change of gain of 7 db was obtained from 0 deg to 60 deg scan angle in comparison with the original design. Author

N73-23289*# Bolt, Beranek, and Newman, Inc., Cambridge, Mass.
STUDY OF POROUS SURFACE MICROPHONES FOR ACOUSTIC MEASUREMENTS IN WIND TUNNELS
D. U. Noiseux Apr. 1973 101 p ref
(Contract NAS2-6844)
(NASA-CR-114593; BBN-2539) Avail: NTIS HC $7.25 CSCL 09A

Porous surface sensors acting as directional microphones in subsonic airflow were investigated. The first part of the report deals with the design of a porous strip sensor set in an aerofoil. The second part presents the experimental results of frequency response, directivity, and flow noise of a porous pipe sensor and a porous strip sensor. For flow noise, these sensors were compared with the Bruel and Kjaer half-inch condenser microphone with a nose cone. The flow noise was examined under two conditions of flow: in a very quiet flow where the turbulence

was approximately 0.3% and in a spoiled flow where the turbulence was approximately 5%. Author

N73-23290*# National Aeronautics and Space Administration. John F. Kennedy Space Center, Cocoa Beach, Fla.
VOLTAGE MONITORING SYSTEM Patent Application
Carl L. Canicatti, inventor (to NASA) Filed 6 Apr. 1973 18 p (NASA-Case-KSC-10736-1; US-Patent-Appl-SN-348787) Avail: NTIS HC $3.00 CSCL 09E

A system for monitoring at a remote location is described for determining when the voltage exceeds upper and lower levels. The system includes transmission lines for transmitting the voltage back to a central station. One of the amplifier outputs is applied to an oscillograph. The other output is fed through an isolation transformer, a full wave rectifier to a pair of unijunctional transistor circuits for producing pulses when the voltage exceeds or drops below a predetermined level. These pulses, in turn, energize a relay which turns on the oscillograph for recording the voltages being monitored. NASA

N73-23291*# Bell Aerospace Co., Buffalo, N.Y.
CORRELATION TYPE PHASE DETECTOR Patent Application
William D. T. Davies and Stephen C. Martin, inventors (to NASA) Filed 20 Apr. 1973 24 p HC $3.25 (NASA-Case-GSC-11744-1; US-Patent-Appl-SN-353162) Avail: NTIS CSCL 09E

A correlation type phase detector is reported wherein integrator means is activated for a time period that is an integral multiple of the period of a signal being measured. The device is utilized as part of a receiver processing system responsive to range indicating variable phase tones. NASA

N73-23292*# General Electric Co., Philadelphia, Pa. Missile and Space Div.
DEVELOPMENT OF A LIQUID METAL SLIP RING Final Report
S. M. Weinberger Nov. 1972 226 p refs
(Contract NAS3-13730)
(NASA-CR-120885; GE-72SD4241) Avail: NTIS HC $13.50 CSCL 09A

A liquid metal slip ring/solar orientation mechanism was designed and a model tested. This was a follow-up of previous efforts for the development of a gallium liquid metal slip ring in which the major problem was the formation and ejection of debris. A number of slip ring design approaches were studied. The probe design concept was fully implemented with detail drawings and a model was successfully tested for dielectric strength, shock vibration, acceleration and operation. The conclusions are that a gallium liquid metal slip ring/solar orientation mechanism is feasible and that the problem of debris formation and ejection has been successfully solved. Author

N73-23293*# Martin Marietta Corp., Denver, Colo. Aerospace Div.
FREQUENCY DIVISION MULTIPLEXER CODE 04236, SERIAL NO. 001, PHASE 2 Final Report
G. Hauge [1973] 41 p ref
(Contract NAS8-25987)
(NASA-CR-124250; MCR-73-91) Avail: NTIS HC $4.25 CSCL 09E

Design principles and test results of modifications to two wideband channels, 8 kHz DS located at 44kHz and 16 kHz SSB located at 104 kHz, are given. Data cover power supply modifications, wideband operational amplifiers, trade-off to determine requirements for precision components, printed circuit board layout, applicability of orginial equipment specification No. 110438, and optimum wideband channel design. Author

N73-23294*# National Aeronautics and Space Administration. Marshall Space Flight Center, Huntsville, Ala.
FLAT CONDUCTOR CABLE SYMPOSIUM
James D. Hankins 8 Dec. 1972 611 p refs Symp. held at Huntsville, Ala., 10-12 Oct. 1972
(NASA-TM-X-64716) Avail: NTIS HC $32.75 CSCL 09A

Conference papers are presented dealing with cables, connectors, termination techniques, electrical characteristics, aerospace applications, and non-aerospace applications. For individual titles, see N73-23295 through N73-23318.

N73-23295* National Aeronautics and Space Administration. Marshall Space Flight Center, Huntsville, Ala.
WHY FCC
Wilhelm Angele *In its* Flat Conductor Cable Symp. 8 Dec. 1972 9 p (For availability see N73-23294 14-09)
CSCL 09A

Summaries are given of design characteristics and various advantages of FCC use. The information is presented in tables that include the following headings: (1) mechanical design, (2) electrical design, (3) manufacturing advantages, (4) inspection and reliability, and (5) cost savings. In addition, the results are summarized of a Saturn 4B FCC-RWC comparison study. D.L.G.

N73-23296* Hughes Aircraft Co., Newport Beach, Calif.
CABLE MANUFACTURE
Paul Gamble *In* NASA. Marshall Space Flight Center Flat Conductor Cable Symp. 8 Dec. 1972 22 p refs (For availability see N73-23294 14-09)
CSCL 09A

A survey is presented of flat electrical cable manufacturing, with particular reference to patented processes. The economics of manufacture based on an analysis of material and operating costs is considered for the various methods. Attention is given to the competitive advantages of the several processes and their resulting products. The historical area of flat cable manufacture is presented to give a frame of reference for the survey. Author

N73-23297* Hughes Aircraft Co., Culver City, Calif.
CABLE DESIGN
B. A. Gerpheide *In* NASA. Marshall Space Flight Center Flat Conductor Cable Symp. 8 Dec. 1972 25 p (For availability see N73-23294 14-09)
CSCL 09A

The importance of material selection is stressed in the design and manufacture of FCC. Several applications of flat conductor cable are discussed relative to material selection and the reasons for using a particular material for each application is explained. Author

N73-23298* Allied Chemical Corp., Morristown, N.J.
HALAR FLUOROPOLYMER: A VERSATILE INSULATION MATERIAL c18
A. B. Robertson *In* NASA. Marshall Space Flight Center Flat Conductor Cable Symp. 8 Dec. 1972 14 p (For availability see N73-23294 14-09)
CSCL 11D

Research directed toward developing materials for the wire and cable industry has resulted in a new product, E-CTFE copolymer, which has an outstanding combination of electrical, thermal, and mechanical properties. The properties of E-CTFE are discussed and compared with those of other commercial fluoropolymers. Particular attention is given to the utility of E-CTFE as a wire and cable insulation. Author

N73-23299* Middle Tennessee State Univ., Murfreesboro.
THERMAL CHARACTERISTICS UNDER LOAD
Robert F. Carlton *In* NASA. Marshall Space Flight Center Flat Conductor Cable Symp. 8 Dec. 1972 28 p (For availability see N73-23294 14-09)
CSCL 09A

A theoretical study was made of the temperature profile in a flat conductor cable. The conductor temperature rise was determined under full load and partial load conditions in an air environment as a function of the current. Similar results were obtained for the fully loaded single cable in vacuum and also for the case of one side of the cable in contact with a heat sink. The results are in good agreement with experimental values, where available. Author

N73-23300* John C. Calhoun State Technical Junior Coll., Athens, Ala.
ELECTRICAL IMPEDANCE OF FCC
Yiu Sing Liu *In* NASA. Marshall Space Flight Center Flat Conductor Cable Symp. 8 Dec. 1972 34 p refs (For availability see N73-23294 14-09)
CSCL 09A

The electrical characteristics of FCC are investigated in the

context of multiple transmission lines theory. Analytical expressions for the coefficients of capacitance of conductors in a single cable are obtained. Numerical values calculated with these expressions are in good agreement with experimental data. Crosstalk, attenuation constants and phase angles of the current and voltage in flat conductor cable are also calculated. Author

N73-23301* General Electric Co., Pittsfield, Mass.
ANALYTICAL PREDICTION OF DIGITAL SIGNAL CROSS-TALK OF FCC
A. P. Bellelsle *In* NASA. Marshall Space Flight Center Flat Conductor Cable Symp. 8 Dec. 1972 30 p (For availability see N73-23294 14-09)
CSCL 09A

The results are presented of study effort whose aim was the development of accurate means of analyzing and predicting signal cross-talk in multi-wire digital data cables. A complete analytical model is developed n + 1 wire systems of uniform transmission lines with arbitrary linear boundary conditions. In addition, a minimum set of parameter measurements required for the application of the model are presented. Comparisons between cross-talk predicted by this model and actual measured cross-talk are shown for a six conductor ribbon cable. Author

N73-23302* North American Rockwell Corp., Downey, Calif.
MANUFACTURING AND QUALITY CONTROL OF FCC HARNESSES
W. L. Malohm and J. Vandergriff *In* NASA. Marshall Space Flight Center Flat Conductor Cable Symp. 8 Dec. 1972 89 p (For availability see N73-23294 14-09)
CSCL 09A

The Saturn 5 program contractors encountered many technological challenges and problems relative to inter-connecting wiring and cabling during the development stages of the Saturn program. The knowledge gained from solving these problems, plus recently developed state-of-the-art techniques, materials, and processes were documented in a report prepared for NASA/MSFC. The portions of that report which deal with FCC harnesses are presented. Author

N73-23303* Bendix Corp., Sidney, N.Y.
ENERGY PULSE BONDING
Gerald C. Smith *In* NASA. Marshall Space Flight Center Flat Conductor Cable Symp. 8 Dec. 1972 22 p refs (For availability see N73-23294 14-09)
CSCL 09A

To eliminate many of the present termination problems a technique called energy pulse bonding (EPB) was developed. The process demonstrated the capability of: (1) joining conductors without prior removal of insulations, (2) joining conductors without danger of brittle intermetallics, (3) increased joint temperature capability, (4) simultaneous formation of several bonds, (5) capability of higher joint density, and (6) a production oriented process. The following metals were successfully bonded in the solid state: copper, beryllium copper, phosphor bronze, aluminum, brass, and Kovar. Author

N73-23304* Boeing Co., Seattle, Wash. Commercial Airplane Group.
TRANSITION SPLICES AND COST COMPARISON
M. Dalmado Remedios *In* NASA. Marshall Space Flight Center Flat Conductor Cable Symp. 8 Dec. 1972 35 p (For availability see N73-23294 14-09)
CSCL 09A

The development and testing of two designs of transition splices are reported. The design goal was to produce splice terminations that are electrically insulated to withstand the environmental conditions of commercial aircraft and are capable of being repaired and reworked on installed cables with the use of hand tools. In addition, a cost study comparison of FCC vs. RCC is reported. The comparison was made on a basis of 10 aircraft with each vehicle using approximately 100,000 feet of wiring and 2,000 connectors. The results are tabulated for seven different wiring configurations. D.L.G.

N73-23305* Raychem Corp., Menlo Park, Calif.
DEVELOPMENT OF A FLAT CABLE SYSTEM
Robert M. Neel *In* NASA. Marshall Space Flight Center Flat Conductor Cable Symp. 8 Dec. 1972 26 p (For availability see N73-23294 14-09)
CSCL 09A

A flat conductor cabling system for electrical/electronic interwiring is described. Six major items comprise the system: the cables, plices - one for flat cable to round wires and one for flat cable to flat cable; a series of flat cable connectors; the distributor, which is used for interconnecting the circuits; and a repair technique for the flat cable. Polyarylene, a new high performance melt-processable insulation material, permits the design of a completely standardized, modular flat conductor flat cable. The development of an advanced heat-shrinkable plastics technology involving the use of selectively bonded plastic film has resulted in the multiple termination module, used for making high-reliability sealed solder terminations to either flat conductor cable or round wires. All necessary tools and application equipment are included in the system design. Author

N73-23306* Defense Electronics Supply Center, Dayton, Ohio.
MILITARY USAGE OF CONNECTORS
Richard Schade *In* NASA. Marshall Space Flight Center Flat Conductor Cable Symp. 8 Dec. 1972 51 p (For availability see N73-23294 14-09)
CSCL 09A

Military specifications with general purpose parameters and termination data covering flat connectors and flat cables are proposed. The material, design, coating, and insulation are discussed, and drafts of specifications for flat cables including quality assurance provisions, and inspection are presented. F.O.S.

N73-23307* National Aeronautics and Space Administration. Marshall Space Flight Center, Huntsville, Ala.
MSFC CONNECTOR DEVELOPMENT
Wilhelm Angele *In its* Flat Conductor Cable Symp. 8 Dec. 1972 10 p (For availability see N73-23294 14-09)
CSCL 09A

NASA flat conductor cable connectors with individually sealed contacts are described. Descriptions of the design, main features, contact spring, connector electrical data, dimensions and weight, FCC termination, and keying system for plug and receptacle are included. F.O.S.

N73-23308* Burndy Corp., Norwalk, Conn.
DESCRIPTION OF CRIMP CONTACT
Jon Wigby *In* NASA. Marshall Space Flight Center Flat Conductor Cable Symp. 8 Dec. 1972 11 p (For availability see N73-23294 14-09)
CSCL 09A

The Tapecon Mark 2 - no-strip-crimp connection is described. Results of humidity, thermal shock, corrosion, and life tests are included. F.O.S.

N73-23309* National Security Agency, Fort Meade, Md.
CONNECTOR INTERCHANGEABILITY
Thomas Berilla *In* NASA. Marshall Space Flight Center Flat Conductor Cable Symp. 8 Dec. 1972 34 p (For availability see N73-23294 14-09)
CSCL 09A

The application is discussed of the general rules of ANSI Y14.5 in designing connectors for interchangeability, and lowering costs. The general rules are applied to actual connector designs, and existing specifications are identified that (1) reject better quality products than those accepted, (2) accept products which should be rejected, and (3) impose unnecessary, nonfunctional costly requirements. F.O.S.

N73-23310* AMP, Inc., Harrisburg, Pa.
CJ CONCEPT FOR ADVANCED AIRCRAFT WIRING
Jack Redslob *In* NASA. Marshall Space Flight Center Flat Conductor Cable Symp. 8 Dec. 1972 7 p (For availability see N73-23294 14-09)
CSCL 09A

The techniques and hardware are described which were developed for facilitating the use of flexible flat conductor cable (FFCC) in commercial air transports. The system was designed as an evolutionary transition from the current round wire harnessing to the use of FFCC harnesses. The equipment discussed

includes the pressure crimp barrel designed for terminating FFCC, reel-fed applicator, cable connectors and adaptors, and equipment racks. F.O.S.

N73-23311* Boeing Co., Seattle, Wash.
ADVANCED WIRING TECHNIQUE AND HARDWARE APPLICATION: AIRPLANE AND SPACE VEHICLE
H. L. Ernst and C. D. Eichman *In* NASA. Marshall Space Flight Center Flat Conductor Cable Symp. 8 Dec. 1972 21 p (For availability see N73-23294 14-09)
CSCL 09A

An advanced wiring system is described which achieves the safety/reliability required for present and future airplane and space vehicle applications. Also, present wiring installation techniques and hardware are analyzed to establish existing problem areas. An advanced wiring system employing matrix interconnecting unit, plug to plug trunk bundles (FCC or ribbon cable) is outlined, and an installation study presented. A planned program to develop, lab test and flight test key features of these techniques and hardware as a part of the SST technology follow-on activities is discussed. Author

N73-23312* North American Rockwell Corp., Downey, Calif.
STATUS AND AVAILABILITY OF FCC HARDWARE
G. K. Romriell *In* NASA. Marshall Space Flight Center Flat Conductor Cable Symp. 8 Dec. 1973 5 p (For availability see N73-23294 14-09)
CSCL 09A

The source availability of FCC and/or FCC connectors was surveyed. The results for the following areas are presented: (1) cost of FCC versus standard round cable, (2) qualification status, (3) size of wire available in FCC, (4) availability of hermetic connectors for FCC, (5) conversion from flat cable to round cable and visa versa, (6) availability of shielded flat cable for RF usage, (7) termination techniques, and (8) repair techniques. F.O.S.

N73-23313* Hobby Hill, Inc., Chicago, Ill.
LOW VOLTAGE FCC FOR HOME AND BUSINESS
Leo Wolf *In* NASA. Marshall Space Flight Center Flat Conductor Cable Symp. 8 Dec. 1972 11 p (For availability see N73-23294 14-09)
CSCL 09A

A thin pressure-sensitive FCC for low voltage usage is described. It is recommended for installing in speakers, intercoms, doorbells, burglar alarms, and clocks, without running wires between walls. The specifications are given. F.O.S.

N73-23314* National Aeronautics and Space Administration. Marshall Space Flight Center, Huntsville, Ala.
FCC FOR HOMEWIRING
J. D. Hankins *In its* Flat Conductor Cable Symp. 8 Dec. 1972 16 p (For availability see N73-23294 14-09)
CSCL 09A

The application of flat conductor cable technology to surface mounted homewiring was investigated. Baseboard concepts, safety aspects, problems, and advantages are discussed. F.O.S.

N73-23315* Bendix Corp., Ann Arbor, Mich. Aerospace Systems Div.
FCC FOR ALSEP (LUNAR EXPERIMENT)
George Cripps *In* NASA. Marshall Space Flight Center Flat Conductor Cable Symp. 8 Dec. 1972 16 p (For availability see N73-23294 14-09)
CSCL 09A

The use of FCC in the ALSEP is discussed. Cable requirements, tradeoffs with round wire, design and development problems are described. F.O.S.

N73-23316* Radio Corp. of America, Moorestown, N.J. Missile and Surface Radar Div.
CABLING DESIGN FOR PHASED ARRAYS
Irving D. Kruger and Leonard Turkiewicz *In* NASA. Marshall Space Flight Center Flat Conductor Cable Symp. 8 Dec. 1972 8 p Reprinted (For availability see N73-23294 14-09)
(Re-18-1-14) CSCL 09A

The ribbon-cabling system used for the AEGIS phased array which provides minimum cable bulk, complete EMI shielding, rugged mechanical design, repeatable electrical characteristics, and ease of assembly and maintenance is described. The ribbon cables are 0.040-inch thick, and in widths up to 2 1/2 inches. Their terminations are molded connectors that can be grouped in a three-tier arrangement, with cable branching accomplished by a matrix-welding technique. Author

N73-23317* Celesco Industries, Costa Mesa, Calif.
FCC IN VIKING ARTICULATED BOOM
E. S. Hawkins *In* NASA. Marshall Space Flight Center Flat Conductor Cable Symp. 8 Dec. 1972 16 p (For availability see N73-23294 14-09)
CSCL 09A

The application requirements and manufacturing techniques for the flat conductor cable used in the Viking Lander Articulated Boom Unit are described. The Viking Boom is a 3-axis device utilized to position a soil sampler and provide digging forces. This application imposed severe restrictions on size, weight, materials, and choice of manufacturing processes. The final cable assembly design resulted in a combination of collated cable and flexible circuits assembled by resistance welding techniques. Author

N73-23318* Hayes International Corp., Huntsville, Ala.
MILITARY AND AEROSPACE APPLICATIONS OF FCC
Candace Swanson *In* NASA. Marshall Space Flight Center Flat Conductor Cable Symp. 8 Dec. 1972 24 p ref (For availability see N73-23294 14-09)
CSCL 09A

Military and NASA programs are discussed in which FCC were used. Included are Saturn 4, Pegasus satellites solar, array for Skylab orbital workshop, Poseidon missiles, MK 48 torpedo fire control, and Lunar Surveyor. F.O.S.

N73-23319# Air Force Systems Command, Wright-Patterson AFB, Ohio. Foreign Technology Div.
THE MECHANICAL SYSTEM OF HIGH-SPEED ELECTRIC MOTORS
L. N. Shashanov 26 Dec. 1972 158 p refs Transl. into ENGLISH of the publ. "Mekhanicheskaya Sistema Vysoko-Skorostnykh Elektrodvigateley" USSR, 1971 p 1-136
(AF Proj. 7343)
(AD-756705; FTD-HC-23-958-72) Avail: NTIS CSCL 09/3

The following topics are discussed: Basic directions in the use of high speed electric motors in modern machine construction; Anti-friction bearings of high speed electric motors; Slider type bearings of high speed electric motors; Slider type bearings of high speed electric motors working without lubrication; and, Bearing units of high speed electric motors. GRA

N73-23320# Raytheon Co., Waltham, Mass. Research Div.
ANALYSIS OF INTERDIGITAL TRANSDUCERS FOR ACOUSTIC SURFACE WAVE DEVICES Final Report, 15 Dec. 1971 - 14 Dec. 1972
Roger H. Tancrell and Frank Sandy 14 Mar. 1973 31 p
(Contract F19628-72-C-0137; AF Proj. 5635)
(AD-757485; S-1524; AFCRL-TR-73-0030) Avail: NTIS CSCL 09/1

A computer program has been written for the theoretical analysis of interdigital transducers for acoustic surface wave devices. The theory is based on an equivalent circuit model for the acousto-electric interactions. Results are presented in both the frequency and time domains. The program can analyze any general transducer geometry. The program is written in FORTRAN IV for the CDC 6600 computer. Author (GRA)

N73-23321# Stanford Univ., Calif. Microwave Lab.
THE TRAVELING SPACE CHARGE WAVE GaAs AMPLIFIER Technical Report, 6 Apr. - 5 Oct. 1972
G. S. Kino, P. Antognetti, G. R. Bisio, and S. Kofol Jan. 1973 35 p refs
(Contract F30602-72-C-0269)
(AD-757219; ML-2117; TR-1; RADC-TR-72-352) Avail: NTIS CSCL 09/1

One batch of amplifiers with Schottky-barrier input gates was made. All the devices tended to oscillate, although the available theory predicted a stable behavior. An investigation was started to determine whether higher order modes were responsible for the unstable behavior. In the meantime, a new

design was carried out with Schottky-barrier input and output gates, and a new rf test fixture was fabricated and tested. Theoretical investigations of the dc field distribution along the device and the input-output impedance along the device was carried out. Author (GRA)

N73-23322# Stanford Research Inst., Menlo Park, Calif.
DRIVING POINT IMPEDANCE MEASUREMENT AND BALUN DESIGN FOR SPIRAL ANTENNAS Final Report on Task A
William B. Weir and Lloyd A. Robinson Mar. 1972 111 p refs Sponsored by Dept. of State
(SRI Proj. 1370)
(AD-756706) Avail: NTIS CSCL 09/5

Measured impedance data are presented for two planar, equiangular, printed-circuit, two-arm, spiral antennas not mounted over cavities. Compact baluns with flat form factors were designed to match the average antenna impedance over the radiating frequency band found from these measurements, to an unbalanced 50-ohm impedance. The measured impedance and loss characteristics of the compact baluns, data showing the effect on antenna impedance of running a twin-lead transmission line close to the antenna, and impedance data for two complete balun/antenna configurations in free space are also presented. (Author Modified Abstract) GRA

N73-23323# Electrospace Systems, Inc., Richardson, Tex.
VHF BROADBAND DIRECTIONAL LOG PERIODIC ANTENNA STUDY Semiannual Report, 1 Mar. - 1 Sep. 1972
William A. Kennedy Dec. 1972 90 p refs
(Contract DAAB07-72-C-0137; DA Proj. 1H6-63707-D-246)
(AD-755199; ECOM-0137-S) Avail: NTIS CSCL 09/5

The report describes the first six months of effort towards the design of a 30-80 MHz VHF Log-Periodic Antenna. Various configurations of log-periodic antennas are considered, and pattern and impedance data on a scale model of the proposed design are included. Author (GRA)

N73-23324# Continental Electronics Mfg. Co., Dallas, Tex.
EXPERIMENTAL MODEL DISPERSIBLE TRANSMITTING ANTENNA VLF/LF Final Report, 1 Mar. - 15 Oct. 1972
Jan. 1973 59 p refs
(Contract F30602-72-C-0234)
(AD-757556; Rept-721015; RADC-TR-73-5) Avail: NTIS CSCL 09/5

The problem was design, installation and testing of a full scale experimental model of an antenna system no more than 100 feet high for the frequency range 27 to 60 kHz having a radiated power of 250 watts and a design goal of 300 watts. The input power is 50 kilowatts. A radiated power of 362 watts was achieved and some modifications and development were required to contain the voltages developed at 50 kilowatts of input power. The system is voltage limited somewhere above this power level depending upon the efficiency and/or bandwidth-efficiency product of the system is approximately 0.85 cycles at the lowest frequency of 27 kHz and increases as the 3.8 power of the frequency ratio. It is shown that the system can be operated at 100 kilowatts input, 250 watts radiated, 377 cycles bandwidth at a frequency of 27 kHz. Author (GRA)

N73-23325# Naval Research Lab., Washington, D.C.
THE ACTION OF DITHER IN DIGITAL MATCHED FILTERS Final Report
J. J. Freeman 1 Feb. 1973 27 p refs Revised
(AD-757013; NRL-7475-Rev) Avail: NTIS CSCL 09/5

An analysis was made of how dither, a large suitably fluctuating component added to the input of a digital matched filter (digital correlator), eliminates capture of a weak signal by an unwanted signal. The signal-to-noise ratio of various correlators with two specific dithers in certain specific jamming environments was analyzed. The correlators analyzed, in comparison with a classical ideal correlator, were a polarity coincidence detector without dither, a polarity coincidence detector with dither of random amplitude uniformly distributed between the chosen plus-and-minus peak values, and a polarity coincidence detector with CW dither, each being analyzed for the cases of Gaussian noise, rectangular-pulse, and CW interference. The choice of dither amplitude based on the measured value of the noise power was studied. In general a uniformly distributed dither was found to be superior to a CW dither. Author (GRA)

N73-23326# Mitre Corp., Bedford, Mass.
INTERFERENCE EFFECTS IN DIGITAL MATCHED FILTERS
P. P. Bratt L. G. Hanscom Field, Mass. ESD Dec. 1972 80 p refs
(Contract F19628-71-C-0002; Mitre Proj. 511A)
(AD-756841; MTR-2469) Avail: NTIS CSCL 09/5

The report contains a summary of some of the more important theoretical results related to the performance of a digital matched filter receiver designed to receive a biphase modulated signal in the presence of interference. Both the synchronization and data performance of the receiver are evaluated when the signal is received in the presence of: (a) Gaussian noise; (b) Random phase sinusoidal interference; (c) Fixed phase sinusoidal interference. Specific attention is paid to the effect of processing the received signal using one bit quantization. Author (GRA)

N73-23327# Air Force Cambridge Research Labs., L. G. Hanscom Field, Mass.
ON THE THREE-TERM THEORY FOR ANALYZING THIN CYLINDRICAL DIPOLE ANTENNAS
Charles J. Drane, Jr. 29 Dec. 1972 32 p refs
(AF Proj. 5635)
(AD-758192; AFCRL-72-0744; AFCRL-PSRP-523) Avail: NTIS CSCL 09/5

The report examines some of the computational problems encountered in applying King and Wu's three-term theory to solution of the integral equation for the current along an electrically thin center-driven cylindrical dipole antenna. According to the theory the current distribution can be approximated by the sum of three trigonometric functions, each of the three terms being multiplied by an unknown constant coefficient. Substituting this representation for the current in the integral equation results in a functional relationship between the coefficients and the variable defining position along the antenna. (Author Modified Abstract) GRA

10 ELECTRONICS

Includes circuit theory; and feedback and control theory. For applications see: 09 Electronic Equipment. For related information see specific Physics categories.

N73-23328# Technische Hogeschool, Eindhoven (Netherlands). Dept. of Electrical Engineering.
DISTRIBUTION FUNCTIONS OF THE SPOT DIAMETER FOR SINGLE- AND MULTI-CATHODE DISCHARGES IN VACUUM
J. E. Daalder and C. W. M. Vos Jan. 1973 29 p refs
(TH-73-E-32; ISBN-90-6144-032-7) Avail: NTIS HC $3.50

The relation between current density in cathode spot and surface conditions was investigated. The results show that the behavior of the discharge varies according to surface conditions. Making use of this effect the crater size of a metal vapor discharge was determined accurately. At a given current value there appeared to be a fairly large variation in diameter according to a distribution function. The peak value of these distribution functions (i.e. the most probable value of the diameter) was a linear function of the current. Investigations of a multicathode discharge show the behavior of the partial discharges to be governed by the same laws. It is stated that the results may contribute to an explanation of the large variation in current density. Finally, a theoretical model based on Joule heating explains some of the phenomena observed. Author

N73-23329# Technische Hogeschool, Eindhoven (Netherlands). Dept. of Electrical Engineering.
JOULE HEATING AND DIAMETER OF THE CATHODE SPOT IN A VACUUM ARC
J. E. Daalder Jan. 1973 18 p refs
(TH-73-E-33; ISBN-90-6144-033-5) Avail: NTIS HC $3.00

Measurements regarding the influence of the cathode surface structure on the movement of a metal vapor discharge in vacuum

were reported. The diameter of the cathode spot as a function of current has been studied and some considerations in order to elucidate the experimental results are outlined. Descriptions of the movement of the discharge and a theoretical calculation of the diameter of a single metal vapor discharge as a function of current are given. Author

N73-23330# Joint Publications Research Service, Arlington, Va.
ADAPTIVE AUTOMATIC SYSTEMS
G. A. Medvedev, ed. 20 Apr. 1973 115 p refs Transl. into ENGLISH from the book "Adaptivnyye Avtomaticheskiye Sistemy" Moscow, Sov. Radio, 1972 p 58-155
(JPRS-58809) Avail: NTIS HC $7.75

The report contains five articles compiled from materials of a seminar on the theory and practice of adaptive systems. These include a study of the adaptive behavior of a collective of automats intended for optimization of multidimensional whole functions; an investigation of discrete automatic systems useful in the analysis of step adaptation algorithms; application of random search in the construction of adaptive algorithms for identification and teaching of automatic systems; an investigation of systems which have found application and are called correlation-extreme systems. For individual titles, see N73-23331 through N73-23335.

N73-23331 Joint Publications Research Service, Arlington, Va.
OPTIMIZATION BY A COLLECTIVE OF INDEPENDENT AUTOMATIC DEVICES WITH ADAPTATION
V. P. Grigorenko, Yu. I. Neymark, A. N. Rapoport, and Ye. I. Ronin *In its* Adaptive Autom. Systems 20 Apr. 1973 p 4-19 refs (For availability see N73-23330 14-10)

The results of a mathematical experiment on the study of adaptive and compensator capabilities of an optimization system by a collective of independent automatic devices are given, which may be presented according to a certain probability law, varying as a function of the evaluation of the activity of the system by the system itself. This change in the law of transposition of the automatic devices may be characterized as a transition from a state of retardation to excitation, and vice versa. As the experiment demonstrated, such a system has considerable adaptive and internal compensator capabilities, preserving (up to a certain limit) a capability for optimization both in internal breakages and external disturbing effects. Author

N73-23332 Joint Publications Research Service, Arlington, Va.
DISCRETE AUTOMATIC SYSTEMS AND STEP ADAPTATION ALGORITHMS
G. A. Medvedev *In its* Adaptive Autom. Systems 20 Apr. 1973 p 20-39 refs (For availability see N73-23330 14-10)

The use of step adaptation algorithms and stochastic graphs for the analysis of discrete automatic systems is explained by the use of a real model whose structure is characterized by the following circumstances: (1) The system operates in discrete time; (2) The control device regulates the object, consisting of series-connected linear link A, nonlinear element B, and linear link C; and (3) Q sub t is the output of the objects being regulated at the moment of time t; x sub t is the controlling effect on the object (control) at moment of time t; and in view of the discrete nature of the variation of time by t, it is convenient to mean the number of the control cycle. Author

N73-23333 Joint Publications Research Service, Arlington, Va.
RANDOM SEARCH IN PROBLEMS OF OPTIMIZATION, IDENTIFICATION, AND TEACHING OF AUTOMATIC SYSTEMS
L. A. Rastrigin *In its* Adaptive Autom. Systems 20 Apr. 1973 p 40-57 refs (For availability see N73-23330 14-10)

Generalized linear teaching algorithms and their application to the construction of specific systems for recognition, classification, and transmission of data are discussed. A.L.

N73-23334 Joint Publications Research Service, Arlington, Va.
PROBLEMS OF THE SYNTHESIS AND ANALYSIS OF CORRELATION-EXTREME SYSTEMS (1)
V. P. Tarasenko *In its* Adaptive Autom. Systems 20 Apr. 1973 p 58-74 refs (For availability see N73-23330 14-10)

An attempt has been made to survey possible methods of the construction of correlation-extreme systems, basic problems of the analysis of phenomena originating in such systems, not dependent upon the specific nature of the object being controlled, and possible fields of application of such systems. Correlation-extreme systems may be used in those cases when the quality of the control of the object is characterized by a degree of proximity of its output to a certain assigned random process. It was proven that, if the degree of this proximity is determined by means of calculation of a mutual correlation function of the random processes being compared, the system will be optimum in an entirely definite sense. Author

N73-23335 Joint Publications Research Service, Arlington, Va.
PROBLEMS OF SYNTHESIS AND ANALYSIS OF CORRELATION-EXTREME SYSTEMS (2)
N. Beloglazov *In its* Adaptive Autom. Systems 20 Apr. 1973 p 75-113 refs (For availability see N73-23330 14-10)

Correlation-extremum systems of type 2 have the following common characteristics: (1) Pickups of the control circuit directly measure a certain random function; (2) There are mandatorily two gauges for measuring the random functions; (3) To obtain information concerning the deviation from the extreme, data from the second gauge are shifted by a magnitude of + or - 1, subtracted from each other, and then multiplied by signal from first gauge; (4) In the control circuit there is a device to measure speed reported by the pickup; and (5) The sweep speed of the random function in the memory block is calculated by means of addition of the measured value of the speed from the pickup and the signal. Several examples are given for the use of this type system in autonomous navigation systems. A.L.

N73-23336# Army Electronics Command, Fort Monmouth, N.J.
STUDY OF TRANSIENT RADIATION EFFECTS ON A MONOLITHIC INTEGRATED CIRCUIT FERRITE PHASE SHIFTER DRIVER
Vincent J. Organic and Henry A. Schauer Jan. 1973 32 p refs
(DA Proj. 1S6-62703-A-440)
(AD-757618; ECOM-4069) Avail: NTIS CSCL 09/5

A study has been performed to determine the permanent performance degradation due to transient radiation on a ferrite phase shifter driven circuit. The driver circuit contained two types of monolithic integrated circuits a large scale integration P-channel metal-oxide-semiconductor circuit to perform the steering logic and a bipolar circuit to perform the high current analog driver function. An analysis was made to predict possible failure modes, and irradiation tests were run on sample circuits. The subsequent test results showed satisfactory circuit performance, up to an irradiation level of approximately 10 to the 13th power n/sq cm (E > or = 10 keV) and gamma radiation of 3 x 10,000 R. Author (GRA)

N73-23337# Purdue Research Foundation, Lafayette, Ind.
CONDUCTION MECHANISMS IN THICK FILM MICROCIRCUITS Semiannual Technical Report, 1 Jul. - 31 Dec. 1972
R. W. Vest 1 Feb. 1973 60 p refs
(Grant DAHC15-70-G7; ARPA Order 1642)
(AD-756254) Avail: NTIS CSCL 09/5

Results from studies of the resistance of RuO2-glass resistors during firing and of the surface tension of the glass are presented, and their correlation with the proposed model for microstructure development discussed. Studies of the removal of the ethyl cellulose - butyl carbitol screening agent led to the conclusion that the last traces of organic materials cannot be removed below 500C. An investigation of the drying of RuO2 . x H2O employing DTA and TGA techniques is discussed, and a procedure described for preparing anhydrous RuO2 with suitable particle size range. Author (GRA)

11 FACILITIES, RESEARCH AND SUPPORT

Includes airports; lunar and planetary bases including associated vehicles; ground support systems; related logistics; simulators; test facilities (e.g., rocket engine test stands, shock tubes, and wind tunnels); test ranges; and tracking stations.

N73-23338# Office National d'Etudes et de Recherches Aerospatiales, Paris (France).
SIMULATION OF A WIND GUST BLOWER [SIMULATION D'UNE RAFALE EN SOUFFLERIE]
J. P. LeHetet, J. Commelin, and P. Lafon Soc. Natl. Ind. Aerospatiale 1972 15 p refs In FRENCH Presented at 9th Conf. on Appl. Aerodyn., Paris, 8 and 10 Nov. 1972 and Saint-Cyr-l'Ecole, France, 9 Nov. 1972
Avail: NTIS HC $3.00

An attempt is made to develop a means of studying the behavior of aircraft in low speed wind gusts and turbulent atmosphere near the ground. Flow profiles are presented and an analysis is made of results obtained by a wind simulation apparatus. Transl. by E.H.W.

N73-23339*# National Aeronautics and Space Administration. Langley Research Center, Langley Station, Va.
DESCRIPTION AND CALIBRATION OF THE LANGLEY 6-BY 19-INCH TRANSONIC TUNNEL
Charles L. Ladson Washington May 1973 64 p refs
(NASA-TN-D-7182; L-8680) Avail: NTIS HC $3.00 CSCL 14B

A description and calibration is presented of the Langley 6-by 19-inch transonic tunnel which is a two-dimensional facility with top and bottom slotted walls used for testing two-dimensional airfoil sections. Basic tunnel-empty Mach number distributions and schlieren flow photographs as well as integrated normal-force coefficients, pitching-moment coefficients, surface-pressure distributions, and schlieren flow photographs of an NACA 0012 airfoil calibration model are presented. The Mach number capability of the facility is from 0.5 to about 1.1 with a corresponding Reynolds number range of 1.5 million to 3 million based on a 4.0-in. model chord. Comparisons of experimental results from the tests with previous data are also presented. Author

N73-23340*# Research Triangle Inst., Research Triangle Park, N.C.
AN ANALYTICAL INVESTIGATION OF ACQUISITION TECHNIQUES AND SYSTEM INTEGRATION STUDIES FOR A RADAR AIRCRAFT GUIDANCE RESEARCH FACILITY, PHASE 2 Final Report Supplement
W. S. Thompson and W. H. Ruedger Apr. 1973 74 p refs
(Contract NAS1-8912)
(NASA-CR-111931-1; RTI-43U-443-1) Avail: NTIS HC $5.75 CSCL 14B

A review of user requirements and updated instrumentation plans are presented for the aircraft tracking and guidance facility at NASA Wallops Station. User demand has increased as a result of new flight research programs; however, basic requirements remain the same as originally reported. Instrumentation plans remain essentially the same but with plans for up- and down-link telemetry more firm. With slippages in the laser acquisition schedule, added importance is placed on the FPS-16 radar as the primary tracking device until the laser is available. Limited simulation studies of a particular Kalman-type filter are also presented. These studies simulated the use of the filter in a helicopter guidance loop in a real-time mode. Disadvantages and limitations of this mode of operation are pointed out. Laser eyesafety calculations show that laser tracking of aircraft is readily feasible from the eyesafety viewpoint. Author

N73-23341# Georgia Inst. of Tech., Atlanta.
ELECTRONIC FACILITY BONDING, GROUNDING AND SHIELDING REVIEW Final Report
H. W. Denny, J. C. Toler, F. P. Holder, J. A. Woody, S. L. Robinette, and R. W. Larson Washington FAA Nov. 1972 121 p refs
(Contract DOT-FA72WA-2850)
(FAA-RD-73-51) Avail: NTIS HC $8.25

The results of a review of grounding, bonding, and shielding practices are presented. The practices are evaluated in terms of their applicability to the enhancement of the operational reliability of the Federal Aviation Administration's air traffic control electronic facilities. Existing standards and specifications related to these practices are critically reviewed as to their appropriateness for FAA facilities. Facility earth grounding requirements are examined in terms of the needs for lightning protection, power fault protection, and signal referencing. Author

N73-23342# Federal Aviation Administration, Washington, D.C.
ENGINEERING AND DEVELOPMENT PROGRAM PLAN: AIRCRAFT WAKE VORTEX AVOIDANCE SYSTEM
Mar. 1972 51 p refs
(FAA-ED-21-1) Avail: NTIS HC $4.75

Efforts to develop a Wake Vortex Avoidance System (WVAS) are discussed. The basic objective of the program is the design of a system to increase runway capacity by removing the capacity-restrictive large spacings now required between aircraft to avoid wake vortex hazards. These large spacings will be replaced by separations tailored to aircraft type and prevailing meteorological conditions. In addition, through the use of vortex sensors, safety will be increased in the terminal area by warning of the existence of vortices in the aircraft approach and departure paths. The program consists of three major task areas: Sensor development, vortex behavior, and hazard definition. These tasks will be integrated into an overall system design. Although the program will require up to five years to complete, interim capabilities specifically directed toward safety will be available in useable form in advance of the completion date. Author

N73-23343# National Bureau of Standards, Washington, D.C. Mechanics Div.
A NEW METHOD FOR GENERATING WATERDROPS OF SPECIFIED MASS
James E. Potzick May 1973 13 p refs
(Contract NAonr-4-72; NBS Proj. 2130470)
(NBS-TN-776) Avail: SOD $0.35 Domestic Postpaid or $0.25 GPO Bookstore

A waterdrop generator was constructed, based on the mechanical resonance of a vibrating waterdrop, which can generate drops of 1.5 to 37 mg with standard deviations in the range of 0.1 percent of drop mass. Drop mass over this range and drop interval are remotely controlled. Author

N73-23344# National Bureau of Standards, Boulder, Colo. Cryogenics Div.
SOME APPLICATIONS OF CRYOGENICS TO HIGH SPEED GROUND TRANSPORTATION
V. D. Arp, A. F. Clark, and T. M. Flynn Feb. 1973 28 p refs
(NBS Proj. 2750101)
(NBS-TN-635) Avail: SOD $0.35 as C13.46:635

The current status (December 1972) of worldwide research on high speed ground transportation techniques is reviewed. Particular attention is given to studies of magnetic levitation using superconducting magnets, including comparison with alternative magnetic techniques and with air suspension systems. Superconducting levitation appears to be a strong contender in the U.S. Department of Transportation hopes to select in the later 1970's the best of the possible levitation techniques for subsequent advanced development. Cryogenic engineering research needed in support of major development of a superconducting levitated system is identified. Author

N73-23345# Mitre Corp., McLean, Va.
MODELS FOR RUNWAY CAPACITY ANALYSIS Final Report
Richard M. Harris Dec. 1972 141 p refs
(Contract DOT-FA70WA-2448)
(MTR-4102-Rev-2; FAA-EM-73-5) Avail: NTIS HC $9.25

Mathematical and simulation models for the calculation of single runway IFR capacity are described. With the basic statistical model one can calculate basic saturation capacity under arrival only and mixed arrival/departure operations. In addition extensions have been made into the analysis of less-than-saturation demand by a simple queueing model, and of speed-class sequencing as a Markov process. A statistical model used to predict capacities for alternative runway configurations, levels of

approach control system precision, and changes in aircraft separation standards. This analysis was performed to compare alternative ways of increasing the IFR capacity of both single and parallel runways. Author

N73-23346# Royal Aircraft Establishment, Farnborough (England).
STAR SIMULATOR CALIBRATION BASED ON THE SPECTRUM OF VEGA
A. G. Gleave Oct. 1972 29 p refs
(RAE-TR-72138; BR-32109) Avail: NTIS HC $3.50

The photometric calibration of a star simulator based on spectrum data of the standard star alpha Lyrae (Vega) of stellar class AOV is described. A calibration check and the results of ground-based and in-flight sensor checks indicate that the calibration accuracy achieved is well within that required for star sensor calibration tests. The spectra of several AOV stars in the visible and ultraviolet spectral regions are discussed. The problems associated with extending the spectral range of the simulated star are considered briefly. Author (ESRO)

N73-23347# Physics International Co., San Leandro, Calif.
PRODUCTION OF ADVANCED X-RAY SOURCES USING INTENSE RELATIVISTIC BEAMS. VOLUME 2: SNARK UPGRADE PROGRAM Final Report, Jan. 1970 - Jun. 1971
P. Champney, G. Hatch, and I. Smith Nov. 1972 56 p refs
(Contract DASA01-71-C-0052; DNA Proj. LA-013)
(AD-755456; PIFR-296-Vol-2; DNA-2979F-2-Vol-2) Avail: NTIS CSCL 20/7

The report describes a program to upgrade the SNARK machine built under DASA contract. In the SNARK program, a machine was built capable of delivering a 50-kJ electron beam to an X-ray target in 50 nsec. Triggered high pressure gas switches were developed to switch the Mylar striplines. The machine delivers the energy to an accelerating tube from two replaceable modules (each containing stacked Mylar stripline Blumleins). With this machine, the concept of modular Mylar energy sources is demonstrated. Author (GRA)

N73-23348# Naval Air Development Center, Warminster, Pa. Air Vehicle Technology Dept.
LIQUID OXYGEN SAMPLER EVALUATION
D. P. Hornick 17 Jan. 1973 22 p
(AD-756629; NADC-73019-30) Avail: NTIS CSCL 14/2

A comparative analysis of the Navy's G-276 Liquid Oxygen Sampler and a modified sampler originally designed by the Naval Air Test Center, Patuxent River, Maryland was made. Evaluation of the samplers was made on the basis of efficiency, reliability, convenience, safety and cost. Author (GRA)

N73-23349# Oceanics, Inc., Plainview, N.Y.
WALL INTERFERENCE ON AIRFOILS IN TRANSONIC TUNNELS AT MACH ONE Final Report
Theodore R. Goodman May 1973 50 p refs
(Contract F44620-72-C-0079; AF Proj. 9781)
(AD-757534; AFOSR-73-0492TR; Rept-73-95) Avail: NTIS CSCL 14/2

A new approximate technique for determining the transonic flow about nonlifting airfoils at Mach 1 is introduced. The technique is based on combining the method of local linearization with an integral method. This combined technique is flexible enough to permit analysis of an airfoil in a transonic wind tunnel in order to determine wind tunnel wall interference effects at Mach 1. The results of carrying out such an analysis indicate that the interference will be negligible whenever a particular condition is satisfied-involving the blockage, the ratio of specific heats, the semiheight of the tunnel, and the chord of the airfoil. (Author Modified Abstract) GRA

N73-23350# Naval Postgraduate School, Monterey, Calif.
A NEW FLUID MECHANICS LABORATORY IN THE DEPARTMENT OF AERONAUTICS
Gustave J. Hokenson Jan. 1973 29 p
(AD-756512; NPS-57HW73012A) Avail: NTIS CSCL 14/2

A brief description of four new experimental fluid mechanics facilities in the Naval Postgraduate School, Department of Aeronautics is presented. Each of the facilities was developed with the capability of studying one classical flow situation thoroughly and extended to include a variety of complex secondary effects which are of current interest. Author (GRA)

N73-23351# Wyle Labs., Inc., Huntsville, Ala. Eastern Operations.
ENVIRONMENTAL IMPACT OF NOISE FROM THE PROPOSED ARNOLD ENGINEERING DEVELOPMENT CENTER (AEDC) HIGH REYNOLDS NUMBER TUNNEL Final Report, 13 Mar. - 30 Jun. 1972
K. J. Plotkin, J. E. Robertson, and J. A. Cockburn Arnold AF Station, Tenn. AEDC Mar. 1973 183 p refs
(Contract F40600-72-C-0007)
(AD-757552; WR-72-7-Rev; AEDC-TR-72-151-Rev) Avail: NTIS CSCL 14/2

A study to evaluate the environmental impact of the noise produced by a proposed high Reynolds number tunnel (HIRT) under consideration at the Arnold Engineering Development Center (AEDC) has been conducted. The studies include theoretical analyses of the noise generation mechanisms associated with the operation of the facility, and scale-model experiments to provide base-line data for extrapolation to full-scale conditions. This assessment contains all pertinent data of relevance to the noise impact which may be anticipated during HIRT operation and includes a specification of acceptable noise limits for people, animals and buildings which will be exposed to HIRT noise, and special considerations for noise protection and control. (Author Modified Abstract) GRA

N73-23352# ARO, Inc., Arnold Air Force Station, Tenn.
MODEL INDUCTION TEST FACILITY CAPABILITY FOR TESTING TURBOFAN ENGINES Final Report, 6 Jul. 1971 - 30 Jun. 1972
James W. Hale AEDC Mar. 1973 33 p ref Sponsored by AEDC
(AF Proj. 2256; ARO Proj. BE2256)
(AD-757197; ARO-ETF-TR-72-189; AEDC-TR-73-10) Avail: NTIS CSCL 14/2

The objective of this model study was to determine the potential for testing very large thrust, high-bypass-ratio, turbofan engines at conditions simulating flight Mach numbers of 0.4 to 0.6, sea level, by use of a jet pumped air supply system. The simulation of low altitude, subsonic operation of a large, high-bypass-ratio, turbofan engine in ground test facilities requires extremely large airflows. This airflow, even at relatively low pressure, cannot be provided by existing test facilities for engines having thrust levels of 60,000 to 100,000 lbf. The jet pumped air supply is therefore a very attractive potential facility. (Author Modified Abstract) GRA

N73-23353# Army Construction Engineering Research Lab., Champaign, Ill.
AN ANALYSIS OF PICKETT'S SOLUTION TO WESTERGAARD'S EQUATION FOR RIGID PAVEMENTS
A. C. Eberhardt Jan. 1973 12 p refs
(DA Proj. 4A6-64717-D-895)
(AD-755526; CERL-TR-S-14) Avail: NTIS CSCL 01/5

Influence coefficients used by the Corps of Engineers for the development of design curves for rigid airfield pavements have been recomputed and extended to permit an expanded and more accurate analysis of large military aircraft such as the C-5A. Calculations were performed using a digital computer in conjunction with a more refined numerical integration technique. Results are compared with the original influence coefficients, and the impact of the more accurate extended table of influence coefficients is evaluated by employing the new and old influence coefficients to calculate edge stress resulting from several representative aircraft gear loads. It is also demonstrated that further accuracy can be obtained by using a non-linear interpolation scheme derived from a bivarient quadratic regression analysis in place of a linear interpolation procedure to extract intermediate values from the table of influence coefficients. Finally, other areas of research which may possibly lead to improvements in the Corps design procedure for rigid airfield pavements are suggested. Author (GRA)

N73-23354# Atmospheric Sciences Lab., White Sands Missile Range, N.Mex.
SOME TEMPERATURE EFFECTS ON THE SUPERSATURA-

TION IN A THERMAL DIFFUSION CHAMBER
Robert S. Bonner Jan. 1973 19 p refs
(DA Proj. 1T0-61102-B-53A)
(AD-758137) Avail: NTIS CSCL 14/2

The report contains experimental information on the temperature characteristics and their effect upon the supersaturation in the thermal diffusion chamber (TDC) of the Cloud Condensation Nuclei (CCN) Collection Detection Recording Instrument used at the Atmospheric Sciences Laboratory, White Sands Missile Range, New Mexico. Four experiments were conducted to determine the extent to which the supersaturation was being influenced by changes in top and bottom plate temperatures and the temperature difference. It was shown that the greater the temperature difference between the plates, the greater the effect of the top plate temperature change on the supersaturation. It was concluded that the sampling flow rate of air through the chamber that had the least effect on the temperature change was 400 cc/min. The overall effect on the supersaturation in the chamber was negligible. Author (GRA)

N73-23355# Army Construction Engineering Research Lab., Champaign, Ill.
INSPECTION OF PAVEMENT GROOVING Technical Report, Dec. 1971 - Jan. 1972
Robert C. Gunkel Kirtland AFB, N. Mex. AFWL Feb. 1973 51 p
(AF Proj. 6111A)
(AD-757208; AFWL-TR-72-149) Avail: NTIS CSCL 01/5

A reinspection of grooved pavements at four commercial and one military airfield was conducted by the Construction Engineering Research Laboratory (CERL) in December 1971 and January 1972. The inspection included grooving in both portland cement concrete (PCC) asphaltic concrete (AC) pavements which had been grooved approximately 4 1/2 years prior to this inspection. Grooves in all PCC pavements were considered to be in excellent condition with no evidence of deterioration on the pavement surface. At one airfield, Kansas City Municipal, numerous surface voids were noted which were due mainly to weathering out of poor quality materials. Many of these surface defects apparently were present at the time of grooving; however, it was apparent that some of the surface defects had developed recently. (Author Modified Abstract) GRA

N73-23356# Army Construction Engineering Research Lab., Champaign, Ill.
A STOCHASTIC NETWORK TO MODEL AIR CARGO TERMINALS
Howard A. Porte, W. W. Happ, C. T. Lee, and L. P. McNamee Feb. 1973 21 p Presented at the Army Sci. Conf., West Point, N. Y., 20-23 Jun. 1972
(AD-757629; CERL-TM-A-7) Avail: NTIS CSCL 01/5

Bottlenecks of the material handling operation of an air cargo terminal are investigated by the stochastic network method of GERT IIIQ. The relationship of the GERTS IIIQ network model to construction specification is discussed. Operations bottlenecks are identified and corrected through modification of facility constraints. (Author Modified Abstract) GRA

N73-23357# Army Construction Engineering Research Lab., Champaign, Ill.
ACTIVITY NETWORKS TO MODEL TRANSPORTATION SYSTEMS SUBJECT TO FACILITY CONSTRAINTS
Howard A. Porte and W. W. Happ Feb. 1973 15 p refs Presented at the 9th Ann Allerton Conf. on Circuit and system Theory, Monticello, Ill., 6-8 Oct. 1971
(DA Proj. 4A6-64717-D-895)
(AD-757628; CERL-TM-A-6) Avail: NTIS CSCL 01/5

Cargo flow through an air cargo terminal is modeled as an activity network by utilizing: deterministic and probabilistic decision-making elements as nodes, activities or branches which relate the nodes and whose characteristics determine the magnitude and delay of commodity flow, and a set of statistical monitors to count events and to perform statistical evaluations at strategic points of the network. Author (GRA)

N73-23358# Stanford Research Inst., Menlo Park, Calif.
FIELD MAPPING OF CW FACILITY Mapping Report
Bruce C. Tupper Jun. 1972 200 p refs
(Contract DAAK02-69-C-0674; SRI Proj. 7990)
(AD-757638) Avail: NTIS CSCL 14/2

Principal and nonprincipal E- and H-field components were mapped for a continuous wave facility installed at Woodbridge, Virginia. The report contains a description of the facility, sensor calibration techniques used, and the resultant fields generated for the ten frequencies used for mapping. A brief analysis of the field structure is given. Author (GRA)

N73-23359# Army Engineer Waterways Experiment Station, Vicksburg, Miss.
EMPLACEMENT AND MAINTENANCE OF DUST-CONTROL MATERIALS
Moody M. Culpepper Sep. 1972 40 p
(DA Proj. 1G6-64717-D-H01)
(AD-756179; AEWES-Instruction-S-72-3) Avail: NTIS CSCL 01/5

The purpose of the report is to provide guidance for those engineer construction troops or troops of the field Army who will emplace and maintain dust-control materials in conjunction with the construction and maintenance of aircraft and helicopter landing facilities. Author (GRA)

N73-23360# Stanford Research Inst., Menlo Park, Calif.
INSTRUMENTATION IMPROVEMENT PROGRAM FOR THE PACIFIC MISSILE RANGE (1971 - 1972 SUMMARY) Final Report, Feb. 1970 - 31 Mar. 1972
John P. McHenry Apr. 1972 31 p refs
(Contract N00019-71-C-0451; SRI Proj. 1166)
(AD-757815) Avail: NTIS CSCL 16/1

The research has covered three primary areas of effort: Support for the Pacific Missile Range at Pt. Mugu, California, on a range improvement program concerned with several aspects of range instrumentation development and upgrading and Support for the Naval Air Systems Command in the analysis and implementation of R-D instrumentation programs that will eventually lead to advanced range instrumentation systems. GRA

N73-22955 Boeing Co., Philadelphia, Pa. Vertol Div.
AERODYNAMIC AND DYNAMIC ROTARY WING MODEL TESTING IN WIND TUNNELS AND OTHER FACILITIES
Franklin D. Harris *In* AGARD Helicopter Aerodyn. and Dyn. Mar. 1973 62 p refs (For availability see N73-22948 14-01)

N73-22956 Boeing Co., Philadelphia, Pa. Vertol Div.
FACTORS IN THE DESIGN AND FABRICATION OF POWERED DYNAMICALLY SIMILAR V/STOL WIND TUNNEL MODELS (APPENDIX 1)
Carl O. Albrecht *In* AGARD Helicopter Aerodyn. and Dyn. Mar. 1973 24 p refs (For availability see N73-22948 14-01)

12 FLUID MECHANICS

Includes boundary-layer flow; compressible flow; gas dynamics; hydrodynamics; and turbulence. For related information see also: 01 Aerodynamics; and 33 Thermodynamics and Combustion.

N73-23361 Engineering Sciences Data Unit, London (England).
INFORMATION ON THE USE OF DATA ITEMS IN THE SERIES BODIES 02.04
Dec. 1971 1 p
(ESDU-Bodies-02.04.00) Copyright. Avail: Issuing Activity

The profile drag of streamlined bodies at small angles of incidence is discussed. The effects of the two components of boundary layer flow are described. It is determined that surface friction drag is dependent upon the conditions of the flow and is generally much less when the flow in the boundary layer is laminar rather than turbulent. The effects of various factors on the movement of the transition point are reported. Author

N73-23362 Engineering Sciences Data Unit, London (England).
DRAG OF STREAMLINE SOLIDS OF REVOLUTION (TRANSITION AT 0.1l BEHIND NOSE)
Sep. 1971 3 p ref

(ESDU-Bodies-02.04.02) Copyright. Avail: Issuing Activity

A numerical analysis of the drag of streamlined bodies of revolution is presented. The total drag coefficient for the bodies with the transition from laminar to turbulent flow at one-tenth body length behind the nose is plotted against Reynolds number for various diameter/length ratios. Limitations of the procedure are explained. A typical example is included and results are plotted in graph form. Author

N73-23363*# National Aeronautics and Space Administration. Lewis Research Center, Cleveland, Ohio.

NONLINEAR EVOLUTION OF A DISTURBANCE IN AN UNBOUNDED VISCOUS FLUID WITH UNIFORM SHEAR

Robert G. Deissler and Burt M. Rosenbaum Washington May 1973 24 p refs

(NASA-TN-D-7284; E-6857) Avail: NTIS HC $3.00 CSCL 20D

The evolution of a disturbance in the presence of a uniform mean velocity gradient is calculated by a power-series solution of the incompressible Navier-Stokes equations. Terms through those in time cubed are retained in the solution. For the initial condition a three-dimensional cosine distribution with two harmonic terms is assumed. The nonlinear interaction of these harmonic terms produces new harmonics which in turn interact. For large velocity gradients the energy of the disturbance can grow with time. The results shed some light on the maintenance or growth of turbulence in a shear flow. Author

N73-23364+ Engineering Sciences Data Unit, London (England).

ONE-DIMENSIONAL ISENTROPIC FLOW OF A THERMALLY PERFECT, CALORICALLY IMPERFECT DIATOMIC GAS

Oct. 1971 11 p refs Sponsored by Roy. Aeronaut. Soc.

(ESDU-S.00.01.10-Amend-A) Copyright. Avail: NTIS Avail: Issuing Activity

An analysis of one dimensional isentropic flow of a thermally perfect, calorically imperfect diatomic gas is presented. Flow equations for determining the ratio of the specific heat capacities for several diatomic gases over a wide temperature range are developed. Numerical relationships expressing the equation of state, momentum equation, energy equation, and their combination into an overall mathematical model are discussed. An example of the flow characteristics is solved numerically and the results are presented in graph form. Author

N73-23365# Defence Research Establishment Valcartier (Quebec).

HYPERSONIC WAKE STUDIES USING COOLED-FILM ANEMOMETER TECHNIQUES

D. Ellington, K. R. Park, and P. Desjardins Sep. 1972 45 p refs

(DREV Proj. 95-51-10)

(DREV-R-648/72) Avail: NTIS HC $4.25

The techniques of cooled-film anemometry have been applied to the determination of temperature and velocity distributions in the wakes of projectiles travelling at hypersonic speeds in a free flight range. The anemometer sensing element comprises a thin platinum film which is deposited on a section of a fine vycor loop through which a refrigerant can be circulated. A gold coating on the remainder of the loop provides an electric connection to a bridge circuit incorporating a feedback system which maintains the sensor at constant resistance and hence constant temperature for frequencies up to 50 kHz. Studies conducted in the wakes of projectiles travelling at 1500 ft/sec in ambient pressures ranging from 1/10th to 1/1000th of an atmosphere have shown that the compressible hypersonic wake is essentially different from the low speed incompressible wake. The latter degenerates rapidly into a fully developed turbulent flow, whereas the former exhibits at least a double structure comprising large scale quasi-periodicty which persists due to the stabilizing influence of the stratification of vortical layers. Author

N73-23366# Institut Aerotechnique de Saint-Cyr, Saint-Cyr-l'Ecole (France).

AN EXAMPLE OF THE UTILIZATION OF A FIXED BLOWER TO PERFORATE A WALL WITH VARIABLE GEOMETRY [ON EXEMPLE D'UTILISATION DE SOVFFLERIE MUNIE DE PAROIS PERFOREES A GEOMETRIE VARIABLE]

M. Menard and Jean-Ch. Vayssaire Paris Soc. Natl. Ind. Aerospatiale 1972 45 p refs In FRENCH Presented at 9th Conf. on Appl. Aerodyn., Paris, 8 and 10 Nov. 1972 and Saint-Cyr-l'Ecole, France, 9 Nov. 1972

Avail: NTIS HC $4.25

The effects of corrections to porous walls, with different ventilated configurations, on transport aircraft model performance are analyzed. The application of theoretical calculations to annular corrections for straight wings and horizontal feathering is discussed. Transl. by E.H.W.

N73-23367# Aeronautical Research Labs., Melbourne (Australia).

THE KINETICS AND EFFECTS OF AIR CONDENSATION IN THE ARL HYPERSONIC WIND TUNNEL

A. S. Kaye Oct. 1972 51 p refs

(ARL/A-139) Avail: NTIS HC $4.75

The degree of supersaturation achieved in a Mach 7.5 wind tunnel has been obtained from static and pitot pressure measurements at several axial stations. It was determined that the supersaturation found in the expansion region of the nozzle is significantly less than expected. Observed variations in pitot pressure with the onset of condensation are shown to be consistent with a standing wave induced by the highly oblique condensation shock. Some observations on the validity of the vapor screen technique for the visualization of shock waves and shear layers are given. Author

N73-23368# Aeronautical Research Inst. of Sweden, Stockholm.

DEVELOPMENT OF A 2-DIM WAKE DRAG EVALUATION SYSTEM

B. Ljungstroem 1973 20 p refs

(FFA Proj. AU-860:1)

(FFA-AU-860) Avail: NTIS HC $3.00

An analog wake drag evaluation system has been developed for the two dimensional insert test section of a low speed wind tunnel. The objective of the development is to obtain accurate drag measurements with a quick read-out capability for two dimensional takeoff type high lift sections. The system consists of a 71 tube total pressure rake connected to a scanivalve mounted on a supporting structure capable of motion in three degrees of freedom and an analog computer and control unit for determining the drag from the pressure measurements. Author

N73-23369# Centre d'Etudes Aerodynamiques et Thermiques, Poitiers (France).

THREE DIMENSIONAL TURBULENT BOUNDARY LAYER CALCULATION AND EXPERIENCE [COUCHE LIMITE TURBULENTE TRIDIMENSIONNELLE, CALCULS ET EXPERIENCES]

J. P. Bernard Paris Soc. Natl. Ind. Aerospatiale 1972 43 p refs In FRENCH Presented at 9th Conf. on Appl. Aerodyn., Paris, 8 and 10 Nov. 1972 in Saint-Cyr-l'Ecole, France, 9 Nov. 1972

Avail: NTIS HC $4.25

An integral method is proposed to calculate the development of three-dimensional turbulent boundary layers; the method uses two transverse parameters, B and C, in the general case. Application of the method to the case of flow in the plane symmetry of a body of revolution incident with upper infinite flow shows good agreement with experimental results and hypothesis. Transl. by E.H.W.

N73-23370# Office National d'Etudes et de Recherches Aerospatiales, Paris (France).

EXPERIMENTAL AND THEORETICAL ANALYSIS OF THREE DIMENSIONAL TURBULENT BOUNDARY LAYER [COUCHE LIMITE TURBULENTE TRIDIMENSIONNELLE ANALYSE EXPERIMENTALE ET THEORIQUE]

Jean Cousteix and Claude Quemard Soc. Natl. Ind. Aerospatiale 1972 29 p refs In FRENCH Presented at 9th Conf. on Appl. Aerodyn., Paris, 8 and 10 Nov. 1972 in Saint-Cyr-l'Ecole, France, 9 Nov. 1972

Avail: NTIS HC $3.50

The application of a mixing length scheme and integral equations to calculate velocity profiles for three-dimensional turbulent boundary layers is discussed. Various other methods and experiments are discussed, compared, and graphed. Transl. by E.H.W.

N73-23371# Avions Marcel Dassault, Saint-Cloud (France).
THREE DIMENSIONAL CALCULATION OF HYPERSUSTENTATION [CALCULS TRIDIMENSIONNELS D'HYPERSUSTENTATION]
P. Perrier and J. J. Deviers Paris Soc. Natl. Ind. Aerospatiale 1972 83 p refs In FRENCH Presented at 9th Conf. on Appl. Aerodyn., Paris, 8 and 10 Nov. 1972 and in Saint-Cyr-l'Ecole, France, 9 Nov. 1972
(Ref-8467) Avail: NTIS HC $6.25

Details are given of experimental and theoretical attempts to obtain a three dimensional representation of hypersustentation during separated flow. Data cover flow coefficients, flow point positions, and flow zones. A comparison with a pseudo-bidimensional representation indicates it is possible to represent, with the aid of a computer, hypersustentation in three dimensions. Transl. by E.H.W.

N73-23372# Societe Nationale Industrielle Aerospatiale, Paris (France).
LONGITUDINAL EVOLUTION OF VELOCITY AND PRESSURE IN A CIRCULAR PIPE WITH PULSE FLOW [EVOLUTION LONGITUDINALE DE LA VITESSE ET DE LA PRESSION DANS UNE CANALISATION CIRCULAIRE EN ECOULEMENT PULSE]
Burnell and Thomas Paris Soc. Natl. Ind. Aerospatiale 1972 40 p refs In FRENCH Presented at 9th Conf. on Appl. Aerodyn., Paris, 8 and 10 Nov. 1972 and in Saint-Cyr-l'Ecole, France, 9 Nov. 1972
Avail: NTIS HC $4.00

A characterization is made of the function of frequency parameters and rate of modulation in circular pipe flow when longitudinal evolution and velocity and pressure signals are given. Signal phase velocity and pressure are also measured. Experimental results are analyzed and compared to results obtained by an analogy between a vibrating fluid system and a mechanical system subjected to forced vibrations. Transl. by E.H.W.

N73-23373# Office National d'Etudes et de Recherches Aerospatiales, Paris (France).
CALCULATIONS OF WALL CORRECTIONS IN TRANSONIC WIND TUNNEL [CALCUL DES CORRECTIONS DE PAROIS EN SOUFFLERIE TRANSSONIQUE]
J. P. Chevallier Soc. Natl. Ind. Aerospatiale 1972 22 p refs In FRENCH Presented at 9th Conf. on Appl. Aerodyn., Paris, 8 and 10 Nov. 1972 and in Saint-Cyr-l'Ecole, France, 9 Nov. 1972
Avail: NTIS HC $3.25

Developments and changes in the hypothesis of the classical correction method used to calculate wall effects are briefly recalled, particularly in the case of flow over slotted or perforated walls. Attempts were made to validate results by applying the method to small transonic perturbations. Transl. by E.H.W.

N73-23374# Societe Bertin et Cie, Plaisir (France).
QUALITATIVE STUDY OF THE DEVIATION OF FLOW BY WALL CAVITIES [ETUDE QUALITATIVE DE LA DEVIATION D'UN ECOULEMENT PAR UNE CAVITE DE PAROI]
R. Mattout Paris Societe Natl. Ind. Aerospatiale 1972 24 p In FRENCH Presented at 9th Conf. on Appl. Aerodyn., Paris, 8 and 10 Nov. 1972 and in Saint-Cyr-l'Ecole, 9 Nov. 1972
Avail: NTIS HC $3.25

The influence of a hollow cylindrical cavity in the half divergent plane of a wall on flow deviation is shown by visualization. Data cover confined flow zones in the cavity, transition zones between principle flow and confined flow, downstream flow principles, and reestablished flow zones. Transl. by E.H.W.

N73-23375# Australian National Univ., Canberra. Dept. of Physics.
NONEQUILIBRIUM NOZZLE EXPANSIONS OF CARBON DIOXIDE FROM A HIGH ENTHALPY RESERVOIR
N. A. Ebrahim and H. G. Hornung 9 Mar. 1973 43 p refs Backup document for AIAA Synoptic scheduled for publication in AIAA Journal in October 1973
(Log-J7197) Avail: NTIS HC $4.25

A numerical study is presented of nonequilibrium nozzle expansions from a reservoir at high specific enthalpy ranging from 3 to 85 x 10 to the 10th power centimeters squared per seconds squared. The features of such expansions are discussed and the effect of uncertainties in the relevant reaction rates is studied in detail. It is found that in this enthalpy range the vibrational modes of the molecular components may be considered to be in equilibrium with translation. The results show that, as in the case of air expansions, the gas composition at large area ratios does not separately depend on reservoir pressure and temperature, but depends only on the reservoir specific entropy. Author

N73-23376*# General Electric Co., Cincinnati, Ohio. Aircraft Engine Group.
STC-SAB PROGRAM USERS MANUAL FOR THE TURBULENT BOUNDARY LAYER AND TURBULENT SEPARATION PREDICTION METHODS EMPLOYED IN THE NASA LANGLEY STREAMTUBE CURVATURE COMPUTER PROGRAM Computer Program User's Manual, Aug. - Nov. 1972
D. R. Ferguson Dec. 1972 158 p refs
(Contract NAS1-10804)
(NASA-CR-112240) Avail: NTIS HC $10.00 CSCL 20D

The streamtube curvature program (STC) has been developed to predict the inviscid flow field and the pressure distribution about nacelles at transonic speeds. The effects of boundary layer are to displace the inviscid flow and effectively change the body shape. Thus, the body shape must be corrected by the displacement thickness in order to calculate the correct pressure distribution. This report describes the coupling of the Stratford and Beavers boundary layer solution with the inviscid STC analysis so that all nacelle pressure forces, friction drag, and incipient separation may be predicted. The usage of the coupled STC-SAB computer program is outlined and the program input and output are defined. Included in this manual are descriptions of the principal boundary layer tables and other revisions to the STC program. The use of the viscous option is controlled by the engineer during program input definition. Author

N73-23377# Joint Publications Research Service, Arlington, Va.
AEROPHYSICAL RESEARCH
11 May 1973 220 p refs Transl. into ENGLISH of the book "Aerofizicheskiye Issledovaniya" Novosibirsk, Acad. of Sci., 1972 138 p
(JPRS-58988) Avail: NTIS HC $13.00

Papers on research in aerophysics and gas dynamics are presented. The research was conducted in 1971 at the Institute of Theoretical and Applied Mechanics of the Siberian Department of the U.S.S.R. Academy of Sciences. Author

N73-23378# ATMA-Association Technique Maritime et Aeronautique, Paris (France).
SUBCRITICAL AND SUPERCRITICAL COMPRESSIBLE SHOCK FLOW IN BLADE CASCADES [ECOULEMENTS COMPRESSIBLES SUBCRITIQUES ET SUPERCRITIQUES SANS CHOC DANS LES GRILLES D'AUBES]
T. S. Luu, G. Coulmy, and A. Grissa Soc. Natl. Ind. Aerospatiale 1972 33 p refs In FRENCH Presented at 9th Conf. on Appl. Aerodyn., Paris, 8 and 10 Nov. 1972 and Saint-Cyr-Ecole, France, 9 Nov. 1972
Avail: NTIS HC $3.75

Poisson type equations are used to study subcritical and supercritical flow about shockless blade cascades. Data cover pressure effects, flow velocity, fluid sliding on profiles, and perturbation. When blade geometry is considered for any angle of attack and for different Mach number values, pressure distribution and down stream flow condition may be determined. Whirlwind intensity and distribution on blade contours are also determined. Transl. by E.H.W.

N73-23379*# Arizona State Univ., Tempe. Engineering Research Center.
PARTICLE-FLUID INTERACTION CORRECTIONS FOR FLOW MEASUREMENTS WITH A LASER DOPPLER FLOWMETER
Neil S. Berman [1972] 61 p refs
(Contract NAS8-21397)
(NASA-CR-124254) Avail: NTIS HC $5.25 CSCL 14B

A discussion is given of particle lags in mean flows, acoustic oscillations at single frequencies and in turbulent flows. Some

simplified cases lead to exact solutions. For turbulent flows linearization of the equation of motion after assuming the fluid and particle streamlines coincide also leads to a solution. The results show that particle lags are a function of particle size and frequency of oscillation. Additional studies are necessary to evaluate the effect of turbulence when a major portion of the energy is concentrated in small eddies. Author

N73-23380# Aviatest G.m.b.H., Duesseldorf (West Germany).
THEORETICAL AND EXPERIMENTAL INVESTIGATION OF THE EXPANSION AND SUPERSONIC BEHAVIOR OF TWO-PHASE WATER-AIR MIXTURES [THEORETISCHE UND EXPERIMENTELLE UNTERSUCHUNGEN ZUM EXPANSIONS- UND UEBERSCHALLVERHALTEN VON ZWEIPHASEN-WASSER-LUFT-GEMISCHEN]
K. F. Leisinger Bonn Bundeswehramt 1973 87 p refs In GERMAN; ENGLISH summary Sponsored by Bundesmin. der Verteidigung
(BMVg-FBWT-73-4) Avail: NTIS HC $6.50; Bundeswehramt, Bonn: 25 DM

The expansion and supersonic characteristics of two phase air-water flows were investigated. The influence of a dissolved part of the gas components in the liquid on the equation of state, the relations for the sound velocity, expansion and normal and oblique shocks were determined theoretically. Principal considerations for the measurement of the sound velocity in two phase supersonic flows show that this velocity and the flow Mach number, as well as the dispersion, can be determined from delay measurements and the harmonic analysis of shocks. The application of X-ray flash density measurement to two phase flows is demonstrated. Tests with nozzle contours are described, but perforated blocks are shown to produce improved two phase flows. ESRO

N73-23381# Deutsche Forschungs- und Versuchsanstalt fuer Luft- und Raumfahrt, Brunswick (West Germany). Inst. fuer Flugmechanik.
STUDIES ON THE UNSTEADY APPROXIMATION METHOD FOR CALCULATION OF THE FRICTIONLESS FLOW PAST BLUNT BODIES AT SUPERSONIC SPEEDS Ph.D. Thesis - Brunswick Univ. [UNTERSUCHUNGEN UEBER DIE INSTATIONAERE METHODE DER BERECHNUNG DER REIBUNGSLOSEN STROEMUNG UM STUMPFE KOERPER BEI UEBERSCHALLGESCHWINDIGKEIT]
Ermin Plaetschke 1973 119 p refs In GERMAN; ENGLISH summary
(DLR-FB-73-10) Avail: NTIS HC $8.00; DFVLR, Porz, West Ger: 21.50 DM

A method for computing the supersonic flow past blunt bodies was investigated. The unsteady approach method considered represents a finite difference method based on the unsteady, i.e. time-dependent, equations of motion. These equations are transformed into difference equations by means of a special finite difference scheme. The solution of the steady problem results as final state of an unsteady transfer. The method is so extended that it becomes independent of the shape of the body. A refinement of the solutions is obtained by an extrapolation procedure. Different plane symmetric and axisymmetric flows are computed and the solutions are compared with experimental and other numerical results. Author (ESRO)

N73-23382# Centre National de la Recherche Scientifique, Meudon (France). Lab. d'Aerothermique.
SEPARATED FLOW ALONG A PLANE WALL WITH A SINUSOIDAL HOLLOW. PART 1: DYNAMIC STUDY OF SUPERSONIC FLOW [DECOLLEMENT SUR UNE PAROI PLANE PRESENTANT UN CREUX DE FORME SINUSOIDALE. PREMIERE PARTIE: ETUDE DYNAMIQUE EN ECOULEMENT SUPERSONIQUE]
B. Prunet-Foch, F. Legay, and G. B. Diep Oct. 1972 44 p refs In FRENCH
(Rept-72-4) Avail: NTIS HC $4.25

The supersonic flow separation and reattachment occurring in the laminar boundary layer along a plane wall with a sinusoidal hollow was investigated, using a two-step calculation. The first, based on the Gruschwitz method, calculated the dynamic field and particularly the velocity profile at the hollow beginning. The second made use of the Dorodnitsyn integral method and calculated the dynamic flow field on the plate. Experimental results agree with theoretical predictions. ESRO

N73-23383# Centre National de la Recherche Scientifique, Meudon (France). Lab. d'Aerothermique.
ROTATION RELAXATION IN CERTAIN TYPES OF FLOW [LA RELAXATION DE ROTATION DANS QUELQUES TYPES D'ECOULEMENTS]
Jean-Claude Lengrand Dec. 1972 31 p refs In FRENCH; ENGLISH summary
(Rept-72-5) Avail: NTIS HC $3.75

Some results on rotational relaxation are applied to nozzle flow, free jets, and Prandtl-Meyer expansions. Conditions are given under which the difference between rotational and translational temperature may be neglected, as well as others under which that difference is large enough to be measured to improve the knowledge of the relaxation time. ESRO

N73-23384# Air Force Systems Command, Wright-Patterson AFB, Ohio. Foreign Technology Div.
CONDITIONS FOR THE EXISTENCE OF A NORMAL SHOCK WAVE IN THE ELEMENTS OF AXIAL SUPERSONIC COMPRESSOR
Yu. N. Vasilev and G. A. Freyman 5 Feb. 1973 28 p Transl. into ENGLISH from Lopatochnye Mash. Struinye App. (Moscow), no. 5, 1971 p 28-44
(AD-756102; FTD-HT-23-1790-72) Avail: NTIS CSCL 13/7

Due to the rise of velocities in the running section of a compressor, of ever increasing interest is the problem dealing with stagnation of supersonic swirling flows in shock waves. In this work, conditions are found for the existence of a normal shock wave in the interblade channels of a rotor and the stator of the axial supersonic stage with a finite number of blades, and equations which permit one to calculate flows satisfying these conditions are given. Author (GRA)

N73-23385# Air Force Systems Command, Wright-Patterson AFB, Ohio. Foreign Technology Div.
STUDY OF THE FLOW AHEAD OF THE CASCADE IN PLANE SUPERSONIC FLOW
A. M. Domashenko 1 Feb. 1973 39 p refs Transl. into ENGLISH from Lopatochnye Mash. Struinye App. (Moscow), no. 5, 1971 p 6-27
(AD-756079; FTD-HT-23-1791-72) Avail: NTIS CSCL 20/4

The author indicates the fact that cascades, under the condition where the gas flow ahead of them is at a supersonic speed, cannot be studied in the same way as cascades where the gas flow ahead is at a subsonic speed. It is shown how the necessary data on the flow ahead of the cascade can be found without resorting to detailed measurements. Author (GRA)

N73-23386# Massachusetts Inst. of Tech., Cambridge.
HYPERSONIC LEADING EDGE PROBLEM: WEDGES AND CONES
Michael L. Shorenstein 17 Feb. 1972 8 p refs Repr. from AIAA Journal, v. 10, no. 9, Sep. 1972 p 1173-1179 Revised (Contract N00014-67-A-0204-0040; ARPA Order 322)
(AD-757037) Avail: NTIS CSCL 20/4

An analysis is given for the viscous hypersonic flow past slender sharp wedges and unyawed cones. The leading edge or nose region treated encompasses the merged layer regime in which the shock thickness is not small in comparison with the viscous layer thickness but for which in the axisymmetric case the shock thickness is small in comparison with the radius of transverse shock curvature. A Navier-Stokes flow is assumed, and both the shock structure and viscous layer are taken to be locally-similar of boundary-layer type. The analysis follows that used by Shorenstein and Probstein for the corresponding flat plate problem. For axisymmetric cone flow, a modification of a transformation introduced by Probstein and Elliott is given to reduce the axisymmetric viscous layer equations including transverse curvature to exactly two-dimensional form. Results for the state conditions behind the shock, and the wall pressure and heat-transfer rate are found to be in good agreement with available experimental data. Author (GRA)

N73-23387# Naval Postgraduate School, Monterey, Calif.
OSCILLATING BODIES IN SUPERSONIC FLOW M.S. Thesis

Rodger Bosley Carter Dec. 1972 141 p refs
(AD-757254) Avail: NTIS CSCL 20/4

Three shapes - a cone, a wedge, and a flat plate - were oscillated at various frequencies up to 16 cycles per second in a Mach 2.8 flow to determine the extent of the validity of the quasi-steady flow assumption. Instantaneous static pressure measurements and schlieren high speed movies were made and analyzed. The frequency was found where the measured pressures started a linear deviation from quasi-steady flow. The absolute pressure being measured, the amplitude, and the transverse velocity of the static pressure port were additional variables. (Author Modified Abstract) GRA

N73-23388# Cincinnati Univ., Ohio. Dept. of Aerospace Engineering.
SUPERSONIC BOUNDARY LAYER SEPARATION AND REATTACHMENT-FINITE DIFFERENCE SOLUTIONS Final Report
Michael J. Werle, Arnold Polak, and Steven D. Bertke Jan. 1973 91 p refs
(Contract N00019-72-C-0136)
(AD-757062; AFL-72-12-1) Avail: NTIS CSCL 20/4

The boundary-layer equations including the effects of interaction with a supersonic mainstream are solved using an implicit finite difference scheme. The free interaction process is studied extensively and favorable comparisons made with experimental data, empirical correlations, and analytical results. Solutions are presented for shockwave and compression ramp induced separations and reattachments for a Mach 3 mainstream at moderate and cold wall temperatures. Surprisingly little overheating is observed aft of reattachment. Author (GRA)

N73-23389# Ultrasystems, Inc., Irvine, Calif.
A STUDY OF IMPLICIT FINITE DIFFERENCE TECHNIQUES FOR COMPRESSIBLE VISCOUS FLOW Final Report
Bruce S. Masson Jan. 1973 34 p refs
(Contract N00014-72-C-0143; NR Proj. 061-179)
(AD-756242; SN-262/FR) Avail: NTIS CSCL 20/4

The purpose of this contract has been to develop numerical procedures for solving the Navier-Stokes equations to study separated flows over wings at transonic speeds and in the near wake of missiles at hypersonic speeds. As a result of this effort a finite difference technique has been developed for the time dependent motion of a viscous compressible gas. The method is intended to permit efficient solution of the equations in both the viscous dominated and inviscid limits. GRA

N73-23390# Naval Ship Research and Development Center, Bethesda, Md. Aviation and Surface Effects Dept.
APPLICATION OF THE METHOD OF INTEGRAL RELATIONS (MIR) TO TRANSONIC AIRFOIL PROBLEMS. PART 2: INVISCID SUPERCRITICAL FLOW ABOUT LIFTING AIRFOILS WITH EMBEDDED SHOCK WAVE
Tsze C. Tai Jul. 1972 76 p refs
(WR0230201)
(AD-755762; AERO-1176-Pt-2; NSRDC-3424-Pt-2) Avail: NTIS CSCL 20/4

Numerical procedures developed in a previous part of the report for applying the method of integral relations to transonic airfoil problems are extended to lifting cases. A modification enables any desired number of strips and size of integration domain to be used. Full inviscid flow equations are approximated by second-order polynomials in transverse direction in a physical plane. Numerical procedures including iterative processes are formulated for the case of high subsonic free-stream Mach numbers. Cartesian coordinates are employed except near the leading edge region where the use of a body coordinate system is convenient. Results are presented for supercritical flows past various airfoils, including two conventional, one advanced, and two shockless airfoils. Author (GRA)

N73-23391# Naval Ordnance Lab., White Oak, Md.
MEASUREMENTS OF A MACH 4.9 ZERO PRESSURE GRADIENT TURBULENT BOUNDARY LAYER WITH HEAT TRANSFER. PART 1: DATA COMPILATION
Robert L. P. Voisinet and Roland E. Lee 27 Sep. 1972 110 p refs
(AD-757330; NOLTR-72-232-Pt-1) Avail: NTIS CSCL 20/4

The results of a detailed experimental investigation of the compressible turbulent boundary layer in a zero-pressure-gradient flow are presented for zero, moderate and severe heat-transfer conditions. The studies were conducted on a flat nozzle wall for a nominal Mach number of 4.9, at momentum thickness Reynolds numbers from 7,000. to 58,000. and at wall-to-adiabatic-wall temperature ratios of 1.0, 0.8 and 0.25. Complete profile measurements were taken with Pitot pressure probes and conical-equilibrium and fine-wire temperature probes. Furthermore, the wall shear and surface heat transfer were measured directly with a skin-friction balance and a heat-transfer gage, respectively. (Author Modified Abstract) GRA

N73-23392# Lehigh Univ., Bethlehem, Pa. Center for the Application of Mathematics.
INTERACTION OF A NONLINEAR GRAVITY WAVE WITH SHEAR FLOWS CONTAINING A VORTEX LAYER
Kai-Nan An and Eric P. Salathe Sep. 1972 44 p ref
(Contract DAAD05-69-C-0053; Themis Proj. 65)
(AD-756469; CAM-110-24; BRL-CR-70) Avail: NTIS CSCL 20/4

The interaction of a large amplitude progressing wave with a piecewise linear shear flow is described. It is assumed that a gravity wave propagates over a horizontal bed into a region of uniform depth. In the undisturbed region ahead of the wave the velocity is at rest for a fixed distance from the bottom, then increases rapidly in a thin layer of constant but large vorticity to a uniform value which it retains up to the free surface. No restriction is placed on the magnitude of the disturbance, so the governing equations are non-linear. The only assumptions are those of classical shallow water theory, i.e., that the fluid is inviscid and that the hydrostatic pressure law may be used. Author (GRA)

N73-23393# Lehigh Univ., Bethlehem, Pa. Center for the Application of Mathematics.
NEAR EQUILIBRIUM NOZZLE FLOWS OF A CONDENSIBLE VAPOR
P. A. Blythe (Queen Mary Coll., London), C. J. Shih, and D. G. Petty Nov. 1972 52 p refs
(Contract DAAD05-69-C-0053)
(AD-756471; CAM-TR-110-25; BRL-CR-85) Avail: NTIS CSCL 20/4

Supersonic nozzle flows of a condensible vapor are discussed in the limit when the collapse of the supersaturated state occurs close to the condensation point. Both homogeneous and heterogeneous nucleation are considered. It is shown that in this limit the collapse is not governed by a condensation shock. Some useful similarity rules are obtained. Author

N73-23394# Air Force Systems Command, Wright-Patterson AFB, Ohio. Foreign Technology Div.
NUMERICAL SOLUTION OF ONE HYDRODYNAMICS EQUATION
D. Kaushilaite 26 Jan. 1973 13 p refs Transl. into ENGLISH from Sb. Rab. Vchisl. Tsent. Mosk. Gos. Univ. (Moscow), no. 15, 1970 p 46-51
(AD-756099; FTD-HT-23-1710-72) Avail: NTIS CSCL 20/4

The difference analog of a problem (equation given) in a region consisting of a finite number of rectangles with boundary gamma is examined. With certain limitations of the region and the parts on the right the theorem of the existence of a single difference solution is proven, as well as the convergence of the iteration process proposed for any initial approximation with an input of specified arithmetic actions. Author

N73-23395# Rhode Island Univ., Kingston. Dept. of Mechanical Engineering and Applied Mechanics.
DIFFUSION OF THERMALLY BUOYANT WATER JETS INTO A MOVING WATER STREAM Project Completion Report, 1 Jul. 1970 - 30 Jun. 1972
Frederick L. Test and Warren M. Hagist 1972 29 p refs
(Contract DI-14-31-0001-3329)
(PB-213461/7; OWRR-B-028-RI(2); W73-02627) Avail: NTIS HC $3.00 CSCL 08H

Presently there are two widely used methods of discharging thermal effluent. The first uses a large single surface jet; this method is used primarily in large lakes and reservoirs where

surface stratification is desired. The second, used for river and estuary sited plants, consists of a large number of closely spaced jets located on the river bottom. To gain a better understanding of the second case, a two-dimensional, submerged slot jet was studied. Mean velocity profiles and turbulent intensities were obtained for unheated jets, and mean temperature profiles were obtained for heated jets. Two angles of jet injection were used with a wide range of velocity ratios. An integral method was developed to predict the trajectory, spreading, velocity decay, and temperature decay of a two-dimensional heated jet. GRA

N73-23396# Naval Postgraduate School, Monterey, Calif.
AN EXPERIMENTAL INVESTIGATION OF THE EFFECTS OF SWIRLING AND PULSING THE FLOW THROUGH AN AXISYMMETRIC DUCT M.S. Thesis
David Cornell Leestma Dec. 1972 109 p refs
(AD-756546) Avail: NTIS CSCL 20/4

It is known that the presence of swirl in a flow stream can affect heat and mass transfer rates, and pulsatile flow has important aspects in physiological studies and in non-steady turbulent flows. The investigation consisted of an experimental study of the generation and decay of swirling flow in a duct utilizing a new method of swirl generation, and the measurement of the fluctuations imposed on the steady turbulent flow profile by pulsing the flow in a duct. New results were obtained that gave insight into the effects of swirling and pulsing the flow through an axisymmetric duct. Author (GRA)

N73-23397# ARO, Inc., Arnold Air Force Station, Tenn.
UPWASH INTERFERENCE ON A SYMMETRICAL WING IN A RECTANGULAR VENTILATED WALL WIND TUNNEL. PART 1: DEVELOPMENT OF THEORY Final Report, Oct. 1971 - May 1972
E. M. Kraft AEDC Mar. 1973 73 p refs
(AF Proj. 1366; ARO Proj. PW5271)
(AD-757196; ARO-PWT-TR-72-162; AEDC-TR-72-187) Avail: NTIS CSCL 14/2

The wind tunnel boundary upwash interference on a symmetrical finite wing of arbitrary lift distribution is calculated in a rectangular test section with solid vertical walls and ventilated (porous-slotted) horizontal walls. The interference is found by applying linearized theory for a compressible medium at subsonic speed to the boundary value problem. The theory uses an image method in addition to Fourier transforms with an equivalent homogeneous boundary condition on the ventilated wall. A treatment of the far downstream end condition consistent with the Fourier transform method is presented. (Author Modified Abstract) GRA

N73-23398# Ballistic Research Labs., Aberdeen Proving Ground, Md.
CORRELATION PARAMETERS FOR TWO DIMENSIONAL JET INTERACTION
Richard E. Lottero Jan. 1973 50 p refs
(DA Proj. 1T0-61102-A-33D)
(AD-757635; BRL-1629) Avail: NTIS CSCL 20/4

The problem considered is the separation of the boundary layer on a flat plate in a high supersonic free stream caused by the normal injection of a two-dimensional sonic or supersonic jet. Only the separation region forward of the jet is discussed. Data from existing literature has been analyzed to form dimensionless correlation parameters that will accurately predict the force, center-of-pressure, and separation length that characterize this forward separation region. Problems related to the nozzle discharge coefficient are discussed. The functional relations of these correlations with respect to changes in jet stagnation temperature and pressure, nozzle throat width, and Mach number for fixed free stream conditions are also discussed. (Author Modified Abstract) GRA

N73-23399# Office of Naval Research, London (England).
FLUID MECHANICS AND FINITE ELEMENTS
David F. Dyer 29 Dec. 1972 18 p refs
(AD-757266; ONRL-R-21-72) Avail: NTIS CSCL 20/4

A report on the International Conference entitled Variational Methods in Engineering, is given. The report describes the interest of the participants at the conference and deals particularly with the part of the conference devoted to fluid mechanic problems. The problem of using variational methods in fluid mechanics is discussed and the papers presented at the conference on this topic are reviewed. It is concluded that it will be difficult to apply variational methods to non-linear problems. Author (GRA)

N73-23400# Purdue Univ., Lafayette, Ind. Project Squid Headquarters.
SPECIE CONCENTRATION AND TEMPERATURE MEASUREMENTS IN FLOW FIELDS
S. Lederman and J. Bornstein Oct. 1972 59 p refs Prepared in cooperation with Polytechnic Inst. of Brooklyn, Farmingdale, N. Y.
(Contract N00014-67-A-0226-0005; NR Proj. 098-038; Proj. Squid)
(AD-757319; SQUID-TR-PIB-31-PU; PIBAL-72-30) Avail: NTIS CSCL 07/4

The Raman scattering technique and its application to the diagnostics of flow fields is discussed, pointing out a number of important positive, as well as negative, features. It is shown experimentally that this technique is capable of providing not only instantaneously and simultaneously pointwise specie concentration in a mixture of polyatomic gases, as well as their temperature in a quiescent mixture of gases, but also in a flow field without the disturbing effects of probes. It is furthermore shown that utilizing the simple, high power pulse technique, the existence of transient fluctuations in the flow field both in terms of specie concentration and temperature can be easily detected. Furthermore, average type of data as obtained using the chromatographic methods can also be obtained without difficulties. Author (GRA)

N73-23401# Boeing Commercial Airplane Co., Renton, Wash.
EVALUATION OF SEPARATION CRITERIA AND THEIR APPLICATION TO SEPARATED FLOW ANALYSIS Final Report, 24 Jan. 1972 - 24 Jan. 1973
Mansop Hahn, Paul E. Rubbert, and Avtar S. Mahal 24 Jan. 1973 81 p refs
(Contract F33615-72-C-1096; AF Proj. 1366)
(AD-757531; D6-41070; AFFDL-TR-72-145) Avail: NTIS CSCL 20/4

Various criteria of turbulent boundary layer separation have been reviewed for two- and three-dimensional flows at subsonic and transonic Mach numbers. Six criteria which predict separation have been evaluated by comparing their predictions with the results of a number of separated flow experiments. A modified form of Townsend's criterion predicts satisfactorily both separation pressure and separation location for subsonic flow. An approach based on calculation of the boundary layer characteristics along the surface has proved to be quite satisfactory for predicting both separation pressure and location for subsonic flow. A boundary condition requiring constant pressure on the surface in the separated region has been used to determine the fluid emission. (Author Modified Abstract) GRA

N73-23402# California Inst. of Tech., Pasadena. Div. of Engineering and Applied Science.
VISCOUS EFFECTS IN INCEPTION AND DEVELOPMENT OF CAVITATION ON AXISYMMETRIC BODIES. PART 1: CAVITATION INCEPTION. PART 2: A SEMI-EMPIRICAL METHOD TO PREDICT CAVITATION SEPARATION ON SMOOTH BODIES
Vijay H. Arakeri Jan. 1973 168 p refs
(Contract N00014-67-A-0094-0023; SR0230101)
(AD-757078; ENG-183-1-Pt-1; ENG-183-1-Pt-2) Avail: NTIS CSCL 20/4

The Schlieren method was adapted as a flow visualization technique for use in water tunnels. The process of cavitation development on two axisymmetric bodies was studied using this approach and found to be greatly influenced by the presence of a previously unreported viscous laminar separation. Approximate computations of the position of transition on a body without laminar separation indicate that the incipient cavitation index is closely correlated with a negative value of the pressure coefficient at the predicted point of transition. Cavitation separation under fully developed conditions was investigated for viscous laminar boundary layer separation under fully wetted conditions. (Author Modified Abstract) GRA

N73-23403# North American Rockwell Corp., Columbus, Ohio. Aircraft Div.
ANALYSIS OF A PULSING WALL JET Final Report, Mar. - Oct. 1972
John R. Williams, Jack P. Ambrosiani, and William E. Palmer 15 Oct. 1972 108 p refs
(Contract N00014-71-C-0259; NR Proj. 215-182)
(AD-758390; NR72H-325) Avail: NTIS CSCL 20/4

An analysis is presented of the mixing characteristics of steady and intermittent blowing when applied for boundary layer control. The analysis considers blowing tangent to the surface of a flap at deflection angles of 0 deg and 40 deg. It is shown that, relative to the steady jet, mixing with the external stream is increased considerably for the intermittent jet.
Author (GRA)

N73-23404# California State Univ., Northridge.
THE 1972 HEAT TRANSFER AND FLUID MECHANICS INSTITUTE Final Report
Charles F. Sanders 28 Mar. 1973 12 p Proc. of 23d Heat Transfer and Fluid Mech. Inst., Northridge, Calif., 14-16 Jun. 1972
(Grants Nonr(G)-0009-72; nonr(G)-0016-72; NSF GK-34147)
(AD-758404) Avail: NTIS CSCL 20/4

In the 1972 Heat Transfer and Fluid Mechanics Institute held at California State University, 173 persons participated. The proceedings of the meeting are presented. (Author Modified Abstract) GRA

N73-23405# Cincinnati Univ., Ohio. Dept. of Aerospace Engineering.
A QUASI-ANALYTICAL METHOD FOR THE CALCULATION OF PARTICLE TRAJECTORIES
G. Grant and W. Tabakoff Feb. 1973 72 p refs
(Grant DA-ARO(D)-31-124-71-G154)
(AD-757724; AROD-10223-3-E; Rept-73-35) Avail: NTIS CSCL 20/4

The equation of motion of a sand particle under the influence of aerodynamic drag has been developed in the inertial coordinate system. The method of solution presented is very easy to use in that only one first order differential equation has to be solved. The equation of motion has been integrated and solved for the special cases of one-dimensional steady flow and one-dimensional accelerating flow as well as the general case of two or three-dimensional accelerating flow. The computerized models of these three problems are presented along with solutions of example problems. High speed movies were taken of sand particles which had been accelerated in a specially designed tunnel. These results demonstrated the extreme accuracy of this method of solution. Author (GRA)

N73-23406# Applied Physics Lab., Johns Hopkins Univ., Silver Spring, Md.
THE EFFECT OF WALL SUCTION ON THE TURBULENT PIPE-FLOW FRICTION COEFFICIENT
R. W. Allen, R. Kalny, and R. W. Newman Jan. 1973 60 p refs
(Contract N00017-72-C-4401)
(AD-757584; APL-TG-1180) Avail: NTIS CSCL 20/4

The report deals with the flow-friction induced by wall suction at the boundary walls of main channels in missile transpiration-cooling systems, gas-turbine heat exchangers, porous-wall chemical reactors, and pipe condensers of space power plants. The pronounced effect of wall suction on the friction of turbulent flow in these systems prompts a search for verified engineering flow-friction correlations. Results of a series of experiments are reported, together with an analysis of related experiments reported earlier in the literature. Comparisons are made with previous porous-pipe turbulent-flow experiments of Weissberg and Berman and with the later porous-pipe experiments of Burnage and the results of the self-similar analytical theory of turbulent pipe-flow with suction are also compared with the experiment. (Author Modified Abstract) GRA

13 GEOPHYSICS

Includes aeronomy; upper and lower atmosphere studies; oceanography; cartography; and geodesy. For related information see also: 20 Meteorology; 29 Space Radiation; and 30 Space Sciences.

N73-23407 Wyoming Univ., Laramie. Remote Sensing Lab.
THE APPLICATION OF REMOTE SENSING DATA APPLIED TO PLANNING IN WYOMING: A DEMONSTRATION PROJECT
10 Jan. 1973 46 p Sponsored by HUD
Avail: Issuing Activity CSCL 05B

An evaluation was made of the use of remote sensing applied to designated land planning tasks in the Power River Basin of Wyoming. Data used for interpretation was obtained through the Earth Resources Technology Satellite Program. Areas covered included: (1) water impoundments and lakes; (2) unstable areas; (3) irrigated versus developed flood plains; (4) coniferous and deciduous tree discrimination; (5) range types and quality; (6) soil types; (7) urban and rural land development; (8) slope estimation; (9) mined areas; (10) mineral resources; (11) construction materials; (12) Gillete urban development; and (13) urban mapping of Casper. A.L.

N73-23408*# Southern Great Plains Watershed Research Center, Chickasha, Okla.
USE OF SPACE DATA IN WATERSHED HYDROLOGY Progress Report, 10 Nov. 1972 - 10 Mar. 1973
Bruce Blanchard, Principal Investigator 10 Mar. 1973 4 p ERTS
(NASA Order S-70251-AG-4)
(E73-10513; NASA-CR-131471) Avail: NTIS HC $3.00 CSCL 08H

There are no author-identified significant results in this report.

N73-23409*# Delaware Univ., Newark. Coll. of Marine Studies.
SATELLITE STUDIES OF SUSPENDED MATTER AND AQUATIC INTERFACES IN DELAWARE BAY
V. Klemas, Principal Investigator, R. Srna, and W. Treasure 22 Feb. 1973 2 p ERTS
(Contract NAS5-21837)
(E73-10515; NASA-CR-131476) Avail: NTIS HC $3.00 CSCL 08C

The author has identified the following significant results. Three successful ERTS-1 satellite passes have produced synoptic imagery showing distribution of suspended matter and aquatic interfaces over Delaware Bay and adjacent Atlantic coastal regions. The interfaces are a major hydrographic feature in Delaware Bay and frequently include regions of high convergence. In the upper and middle bay the interfaces tend to align along the flow axis of the river and parallel to the shoreline. A correlation has been found between the concentration of sand particles in suspension and the depth, suggesting that most of the heavier particles are lifted into temporary suspension over shoals and shallow areas by currents and waves. The second type of interface is primarily a tidal intrusion of shelf water into the bay during incipient flood tide, with associated discontinuities in salinity and temperature. The convergence properties of such fronts attract heavy accumulations of foam which were found to contain strong concentrations of heavy metals and other toxic substances.

N73-23410*# Delaware Univ., Newark. Coll. of Marine Studies.
APPLICATION OF ECOLOGICAL, GEOLOGICAL AND OCEANOGRAPHIC ERTS-1 IMAGERY TO DELAWARE'S COASTAL RESOURCES PLANNING
V. Klemas, Principal Investigator and D. Bartlett 13 Feb. 1973 4 p ERTS
(Contract NAS5-21837)
(E73-10516; NASA-CR-131477) Avail: NTIS HC $3.00 CSCL 08H

The author has identified the following significant results. Coastal vegetation species appearing in the ERTS-1 images taken of Delaware Bay have been correlated with ground truth vegetation maps and imagery obtained from high altitude overflights. Multispectral analysis of the high altitude photographs indicated that four major vegetation communities could be clearly

discriminated from 60,000 feet altitude including: (1) salt marsh cord grass; (2) salt marsh hay and spike grass; (3) reed grass; and (4) high tide bush and sea myrtle. In addition, human impact can be detected in the form of fresh water impoundments built to attract water fowl, dredge-fill operations and other alterations of the coastal environment. Overlay maps matching the USGS topographic map size of 1:24,000 have been prepared showing the four wetland vegetation communities, fresh water impoundments, and alteration of wetlands by mosquito control ditching and dredge-fill operations. Using these maps, ERTS-1 images were examined by human interpreters and automated multispectral analyzers. Major plant communities of (1) Spartina alterniflora, (2) Spartina patens and Distichlis spicata, and (3) Iva frutescens and Baccharis halimifolia can be distinguished from each other and from surrounding uplands in ERTS-1 scanner bands 6 and 7.

N73-23411*# Jet Propulsion Lab., Calif. Inst. of Tech., Pasadena.
STRUCTURAL FEATURES IN THE COLORADO PLATEAU MARGIN NEAR FLAGSTAFF, ARIZONA
Alexander F. H. Goetz, Principal Investigator and Donald P. Elston (Geol. Surv., Flagstaff, Ariz.) [1973] 1 p Sponsored by NASA ERTS
(E73-10517; NASA-CR-131478) Avail: NTIS HC $3.00 CSCL 08E

The author has identified the following significant results. On ERTS-1 frame 1014-17375, a set of northwest-trending lineaments has been discovered which converge on the north-trending lineament of the Oak Creek Fault near Flagstaff, Arizona. The lineaments are most easily seen in band 7. The region of convergence may mark an area structurally favorable for the location of water in Paleozoic sediments that underlie the basalt cap.

N73-23412*# Purdue Univ., Lafayette, Ind. Lab. for Applications of Remote Sensing.
DETECTING CHANGES IN WATER QUALITY AND SURFACE AREA IN TAHOKA LAKE, LYNN COUNTY TEXAS, USING SEQUENTIAL ERTS MSS DATA
Marion F. Baumgardner, Principal Investigator 16 Mar. 1973 1 p ERTS
(Contract NAS5-21785)
(E73-10518; NASA-CR-131481) Avail: NTIS HC $3.00 CSCL 08H

There are no author-identified significant results in this report.

N73-23413*# Arizona Univ., Tucson.
A STUDY TO EXPLORE THE USE OF ORBITAL REMOTE SENSING TO DETERMINE NATIVE ARID PLANT DISTRIBUTION Progress Report, period ending 16 Apr. 1973
William G. McGinnies, Principal Investigator 16 Apr. 1973 4 p ERTS
(Contract NAS5-21812)
(E73-10520; NASA-CR-131487) Avail: NTIS HC $3.00 CSCL 08F

There are no author-identified significant results in this report.

N73-23414*# Texas Instruments, Inc., Dallas.
EVALUATION OF COMMERCIAL UTILITY OF ERTS-A IMAGERY IN STRUCTURAL RECONNAISSANCE FOR MINERALS AND PETROLEUM Progress Report, 1 Mar. - 30 Apr. 1973
Donald F. Saunders, Principal Investigator 8 May 1973 4 p ERTS
(Contract NAS5-21796)
(E73-10523; NASA-CR-131490) Avail: NTIS HC $3.00 CSCL 08G

The author has identified the following significant results. The only area that has been analyzed to date is Area 3 where results have already been reported. However, work progressing in Area 1 and 2 seem to indicate a good correlation between lineament zones previously reported, mineralized areas and lineaments currently being picked from ERTS-1 imagery. There also appear to be many lineaments on ERTS-1 imagery in these areas which have not been reported in any other literature.

N73-23415*# Earth Satellite Corp., Washington, D.C.
APPLICATION OF ERTS-1-DATA TO THE PROTECTION AND MANAGEMENT OF NEW JERSEY'S COASTAL ENVIRONMENT Progress Report, period ending 30 Apr. 1973
Roland S. Yunghans, Edward B. Feinberg, Robert L Mairs, Principal Investigators, Dennid Woodward, David A. Thibault, and Robert T. Macomber 8 May 1973 9 p Prepared for N. J. Dept. of Environ. Protect. ERTS
(Contract NAS5-21765)
(E73-10527; NASA-CR-131566) Avail: NTIS HC $3.00 CSCL 08H

The author has identified the following significant results. New Jersey's planned, regionalized network of sewage disposal facilities has been plotted on an ERTS-1 mosaic and circulation parameters for each of the planned outfall locations have been analyzed using the ERTS-1 imagery and comparative aircraft photography. Work is continuing on the circulation and dispersion of barge-dumped wastes in the New York Bight area. One of the largest remote sensing experiments ever attempted in this country was completed on April 7, 1973 during the ERTS-1 overpass. The test area included the northern portion of New Jersey and the Raritan Bay - New York Harbor area. Three NASA aircraft, two helicopters, nine surface vessels, 40 ground team personnel, and numerous oceanographic, radiometric, and meteorological equipment were deployed in an effort to characterize the surface and near-surface circulation dynamics in this 600 square mile area, during an entire tidal cycle. The analyses of these data in concert with all previous ERTS-1 overpasses will provide information that can lead to a better and more rational use of the nearshore marine environment. The data will be utilized to plan future outfall locations, regulating offshore disposal of wastes, etc.

N73-23416*# Argus Exploration Co., Newport Beach, Calif.
A RECONNAISSANCE SPACE SENSING INVESTIGATION OF CRUSTAL STRUCTURE FOR A STRIP FROM THE EASTERN SIERRA NEVADA TO THE COLORADO PLATEAU Progress Report, 1 Mar. - 30 Apr. 1973
Ira C. Bechtold, Principal Investigator 11 May 1973 10 p ERTS
(Contract NAS5-21809)
(E73-10529; NASA-CR-131594) Avail: NTIS HC $3.00 CSCL 08G

There are no author-identified significant results in this report.

N73-23417*# Earth Satellite Corp., Berkeley, Calif.
PLAN FOR THE UNIFORM MAPPING OF EARTH RESOURCES AND ENVIRONMENTAL COMPLEXES FROM SKYLAB IMAGERY Monthly Progress Report, 2 Jan. - 28 Feb. 1973
Charles E. Poulton, Principal Investigator 28 Feb. 1973 3 p EREP
(Contract NAS9-13286)
(E73-10532; NASA-CR-131597) Avail: NTIS HC $3.00 CSCL 08B

There are no author-identified significant results in this report.

N73-23418*# Bureau of Land Management, Riverside, Calif.
PREDICT EPHEMERAL AND PERENNIAL RANGE QUANTITY AND QUALITY DURING NORMAL GRAZING SEASON Progress Report, 1 Mar. - 30 Apr. 1973
Gordon Bently, Principal Investigator 1 May 1973 4 p ERTS
(NASA Order S-70243-AG-1)
(E73-10541; NASA-CR-131617) Avail: NTIS HC $3.00 CSCL 08F

There are no author-identified significant results in this report.

N73-23419*# Geological Survey, McLean, Va.
CARTOGRAPHIC EVALUATION OF ERTS ORBIT AND ATTITUDE DATA Progress Report, 1 Jan. - 28 Feb. 1973
Robert B. McEwen, Principal Investigator 1 Mar. 1973 45 p ERTS
(NASA Order S-70243-AG)
(E73-10544; NASA-CR-131648) Avail: NTIS HC $4.25 CSCL 08B

There are no author-identified significant results in this report.

N73-23420*# Geological Survey, Menlo Park, Calif.
INVESTIGATION OF PROTOTYPE VOLCANO SURVEILLANCE NETWORK Progress Report, 1 Jan. - 28 Feb. 1973

Jerry P. Eaton, Principal Investigator and Peter L. Ward 1 Mar. 1973 4 p ERTS
(NASA Order S-70243-AG-2)
(E73-10545; NASA-CR-131649) Avail: NTIS HC $3.00 CSCL 08E

The author has identified the following significant results. Earthquake counters in Guatemala were being installed between February 13 and 17. The volcano Fuego began erupting ash and ash flows on February 23. On February 17, 6 days before the eruption there were 80 earthquakes at two counters 5 and 15 km from the volcano. This was a substantial increase of a fairly constant level of events per day recorded for the previous four days. A counter 30 km away did not show an increase. Had the DCP been operating longer and had the data been sent immediately from Goddard, it might have been possible to warn of a possible eruption six days in advance.

N73-23421*# Pacific Southwest Forest and Range Experiment Station, Berkeley, Calif.
INVENTORY OF FOREST AND RANGELAND AND DETECTION OF FOREST STRESS Progress Report, 1 Mar. - 30 Apr. 1973
Robert C. Heller, Principal Investigator, Robert C. Aldrich, Frederick P. Weber, and Richard S. Driscoll 11 May 1973 12 p ERTS
(Nasa Order S-70251-AG)
(E73-10546; NASA-CR-131650; PR-4) Avail: NTIS HC $3.00 CSCL 02F

There are no author-identified significant results in this report.

N73-23422*# Purdue Univ., Lafayette, Ind. Lab. for Applications of Remote Sensing.
A STUDY OF THE UTILIZATION OF ERTS-1 DATA FROM THE WABASH RIVER BASIN Bimonthly Progress Report
D. A. Landgrebe, Principal Investigator 30 Apr. 1973 6 p ERTS
(Contract NAS5-21773)
(E73-10549; NASA-CR-131653) Avail: NTIS HC $3.00 CSCL 05B

The author has identified the following significant results. For the urban land use analysis project, classification results were good to excellent for the following classes: single family residential, commercial/industrial, cloud, cloud shadow, trees, and water. Grassy areas were defined fairly well, but residential areas located between multi-family residential and single-family residential were misclassified as grassy. Residential areas dominated by tree cover, termed wooded residential, were unable to be classified in a single class. Data points in such areas were classified randomly as either grassy or trees.

N73-23423*# Arizona Univ., Tucson. Dept. of Biological Sciences.
STUDY OF THE MARINE ENVIRONMENT OF THE NORTHERN GULF OF CALIFORNIA Progress Report, period ending 30 Apr. 1973
J. R. Hendrickson, Principal Investigator 30 Apr. 1973 7 p ERTS
(Contract NAS5-21777)
(E73-10550; NASA-CR-131849) Avail: NTIS HC $3.00 CSCL 08J

There are no author-identified significant results in this report.

N73-23424*# Purdue Univ., Lafayette, Ind. Lab. for Applications of Remote Sensing.
AN INTERDISCIPLINARY ANALYSIS OF ERTS DATA FOR COLORADO MOUNTAIN ENVIRONMENTS USING ADP TECHNIQUES Bimonthly Progress Report, 1 Mar. - 30 Apr. 1973
Roger M. Hoffer, Principal Investigator 30 Apr. 1973 11 p ERTS
(Contract NAS5-21880)
(E73-10551; NASA-CR-131850) Avail: NTIS HC $3.00 CSCL 08F

There are no author-identified significant results in this report.

N73-23425*# Wyoming Univ., Laramie. Remote Sensing Lab.
MULTIDISCIPLINARY STUDY OF WYOMING TEST SITES Monthly Progress Report
R. M. Breckenridge and R. W. Marrs May 1973 6 p EREP
(Contract NAS9-13298)
(E73-10552; NASA-CR-131851; EREP-1-73A) Avail: NTIS HC $3.00 CSCL 08F

There are no author-identified significant results in this report.

N73-23426*# Wyoming Univ., Laramie. Remote Sensing Lab.
ANALYSIS OF ERTS-1 IMAGERY OF WYOMING AND ITS APPLICATION TO EVALUATION OF WYOMING'S NATURAL RESOURCES Progress Report, Mar. - Apr. 1973
Ronald W. Marrs and Roy M. Breckenridge 15 May 1973 11 p refs ERTS
(Contract NAS5-21799)
(E73-10554; NASA-CR-131853) Avail: NTIS HC $3.00 CSCL 08F

There are no author-identified significant results in this report.

N73-23427*# Geological Survey, Washington, D.C.
IRON-ABSORPTION BAND ANALYSIS FOR THE DISCRIMINATION OF IRON-RICH ZONES Progress Report, 1 Jan. - 28 Feb. 1973
Lawrence C. Rowan, Principal Investigator 26 Apr. 1973 4 p ERTS
(NASA Order S-70243-AG-4)
(E73-10555; NASA-CR-131854) Avail: NTIS HC $3.00 CSCL 08G

The author has identified the following significant results. Lineament analysis of the area was initiated on individual images and then expanded areally by the use of mosaics at the 1:1,000,000 scale. Principal trends are NE, NW, NNE-NNW, and ENE. Several previously unrecognized lineaments are mapped which may be the surface manifestations of major fault or fracture zones. Three lineaments are especially noteworthy. Two of these, the Walker Lane and the Midas Trench lineament system, transect the predominantly NNE-NNW trending mountain ranges for more than 500 km. A third major lineament, formed by the alinement of several topographic escarpments 10-20 km long, is orthogonal to the Midas Trench lineament. This lineament is marked by a distinct positive magnetic anomaly for approximately 200 km. Further visual analysis of ERTS-1 images has resulted in the delineation of 50 circular or elliptical features which are presumed to be volcanic or intrusive centers. A comparison with the 78 Tertiary volcanic centers mapped in the study area in 1970 indicates some good agreement between the proposed and known volcanic centers. The coincidence of some major lineaments and productive ore bodies implies a genetic relationship.

N73-23428*# Geological Survey, Washington, D.C.
THERMAL SURVEILLANCE OF ACTIVE VOLCANOES Progress Report, 1 Feb. - 31 Mar. 1973
Jules D. Friedman, Principal Investigator 1 Apr. 1973 3 p ERTS
(NASA Order S-70243-AG)
(E73-10556; NASA-CR-131855) Avail: NTIS HC #3.00 CSCL 08E

There are no author-identified significant results in this report.

N73-23429*# Geological Survey, Washington, D.C.
CENTRAL ATLANTIC REGIONAL ECOLOGICAL TEST SITE: A PROTOTYPE REGIONAL ENVIRONMENTAL INFORMATION SYSTEM Progress Report, 1 Mar. - 30 Apr. 1973
Robert H. Alexander, Principal Investigator and Herbert K. McGinty 1 May 1973 12 p ERTS
(NASA Order S-70243-AG-3)
(E73-10557; NASA-CR-131856) Avail: NTIS HC $3.00 CSCL 08F

There are no author-identified significant results in this report.

N73-23430*# Geological Survey, Menlo Park, Calif.
INVESTIGATION OF PROTOTYPE VOLCANO SURVEILLANCE Progress Report, 1 Mar. - 30 Apr. 1973
Jerry P. Eaton, Principal Investigator and Peter L. Ward 1 May 1973 3 p ERTS
(NASA Order S-70243-AG-2)
(E73-10558; NASA-CR-131857) Avail: NTIS HC $3.00 CSCL 08E

There are no author-identified significant results in this report.

N73-23431*# Geological Survey, Tacoma, Wash.
EVALUATE ERTS IMAGERY FOR MAPPING AND DETECTION OF CHANGES OF SNOWCOVER ON LAND AND ON GLACIERS Progress Report, 1 Mar. - 30 Apr. 1973
Mark F. Meier, Principal Investigator 30 Apr. 1973 4 p ERTS
(NASA Order S-70243-AG-2)
(E73-10559; NASA-CR-131858) Avail: NTIS HC $3.00 CSCL 08B

The author has identified the following significant results. A possibly more accurate method to determine snowcover area change has been tried; snowcover area change over periods of an ERTS-1 cycle are very useful in determining energy balances over regional areas and to determine snow depth as a function of altitude. Also since shadow and cloud cover areas are highlighted this method may be a step toward more complete machine processing.

N73-23432*# Geological Survey, Miami, Fla.
ACQUISITION AND PROCESSING PROBLEM OF ERTS DATA IN SOUTH FLORIDA Progress Report, 1 Oct. 1972 - 1 Apr. 1973
A. L. Higer, Principal Investigator, E. T. Wimberly, E. H. Cordes, and A. E. Coker Apr. 1973 21 p ref Original contains imagery. Original photography may be purchased from the EROS Data Center, 10th and Dakota Avenue, Sioux Falls, S. D. 57198
(NASA Order S-70243-AG-7)
(E73-10560; NASA-CR-131859) Avail: NTIS HC $3.25 CSCL 05B

There are no author-identified significant results in this report.

N73-23433*# Nevada Univ., Reno. Mackay School of Mines.
[SPECTRAL REFLECTANCE MEASUREMENTS OF PLAYA LAKES] Progress Report, 1-30 Apr. 1973
Jack Quade, Principal Investigator 30 Apr. 1973 2 p EREP
(Contract NAS9-13274)
(E73-10561; NASA-CR-131860) Avail: NTIS HC $3.00 CSCL 08H

There are no author-identified significant results in this report.

N73-23434*# Earth Satellite Corp., Washington, D.C.
PLAN FOR THE UNIFORM MAPPING OF EARTH RESOURCES AND ENVIRONMENTAL COMPLEXES FROM SKYLAB IMAGERY Monthly Progress Report, 1-30 Apr. 1973
Charles E. Poulton, Principal Investigator 30 May 1973 9 p ref EREP
(Contract NAS9-13286)
(E73-10562; NASA-CR-131861) Avail: NTIS HC $3.00 CSCL 08B

There are no author-identified significant results in this report.

N73-23435*# Environmental Research Inst. of Michigan, Ann Arbor.
DEVELOPING PROCESSING TECHNIQUES FOR SKYLAB DATA Monthly Progress Report, 8 Mar. - 8 Apr. 1973
Richard F. Nalepka, Principal Investigator 8 May 1973 1 p EREP
(Contract NAS9-13280)
(E73-10563; NASA-CR-131862; Rept-101900-1-L; MR-1) Avail: NTIS HC $3.00 CSCL 05B

There are no author-identified significant results in this report.

N73-23436*# Wyoming Univ., Laramie. Remote Sensing Lab.
ERTS-1 STUDY OF THE GEOLOGY OF THE ICE-FREE VALLEYS OF ANTARCTICA Progress Report, Mar. - Apr. 1973
Frank Zochol and R. W. Marrs 1 May 1973 6 p refs ERTS
(Contract NAS5-21818)
(E73-10564; NASA-CR-131863; ERTS-ANT-1-73B) Avail: NTIS HC $3.00 CSCL 08G

There are no author-identified significant results in this report.

N73-23437*# Mississippi Test Facility, Bay St. Louis.
EVALUATION OF SATELLITE REMOTE SENSING AND AUTOMATIC DATA TECHNIQUES FOR CHARACTERIZATION OF WETLANDS AND MARSHLANDS Progress Report
Robert H. Cartmill, Principal Investigator 8 May 1973 2 p ERTS
(E73-10576; NASA-TM-X-68226) Avail: NTIS HC $3.00 CSCL 08M

There are no author-identified significant results in this report.

N73-23438*# Stanford Univ., Calif. School of Earth Sciences.
STRUCTURAL AND LITHOLOGIC STUDY OF NORTHERN COAST RANGES AND SACRAMENTO VALLEY, CALIFORNIA Progress Report
Ernest I. Rich, Principal Investigator 1 May 1973 2 p ERTS
(Contract NAS5-21775)
(E73-10577; NASA-CR-131881) Avail: NTIS HC $3.00 CSCL 08E

There are no author-identified significant results in this report.

N73-23439*# Purdue Univ., Lafayette, Ind.
IDENTIFICATION AND MAPPING OF LAND USE CLASSES IN THE KANSAS CITY AREA BY MACHINE PROCESSING OF ERTS-1 DATA
Marion F. Baumgardner, Principal Investigator 18 May 1973 1 p ERTS
(Contract NAS5-21785)
(E73-10578; NASA-CR-131882) Avail: NTIS HC $3.00 CSCL 08B

There are no author-identified significant results in this report.

N73-23440*# Oregon State Univ., Corvallis. School of Agriculture.
COMPARATIVE EVALUATION OF ERTS IMAGERY FOR RESOURCE INVENTORY IN LAND USE PLANNING Progress Report, period ending 30 Apr. 1973
Gerald H. Simonson, Principal Investigator 10 May 1973 10 p ERTS
(Contract NAS5-21831)
(E73-10579; NASA-CR-131883) Avail: NTIS HC $3.00 CSCL 05B

The author has identified the following significant results. Numerous previously unmapped faults in central Oregon have been distinguished on ERTS-1 imagery. Tectonic mapping of fault-controlled linears demonstrates the utility of ERTS-1 imagery as a mean of illustrating and studying the regional tectonics of the state. Soil colors observed on ERTS-1 frame 1075-18150-5 at the eastern end of the Columbia basin correlate very well with those from descriptions of soils from that area. Digital output from frame 1021-18151 has shown the enhanced ability to interpret such features as joint patterns, shadowed landslide blocks, bottomlands, and drainage patterns. Widespread use of wheat-fallow rotation in northern Umatilla County, Oregon, insures that nearly one-half of the cultivated soil is devoid of vegetation much of the time. On ERTS-1 imagery, fallow fields are only slightly darker than fields of wheat stubble at the western end of the transect. Similar climate-related contrasts in soil color are visible on ERTS-1 Imagery from several other portions of the Columbia Basin. Absence of steep topography in the area mentioned, however, minimizes the disturbing effect caused by shadows.

N73-23441*# National Marine Fisheries Service, Bay Saint Louis, Miss.
RELATIONSHIPS BETWEEN REMOTELY SENSED FISHERIES DISTRIBUTION INFORMATION AND SELECTED OCEANOGRAPHIC PARAMETERS IN THE MISSISSIPPI SOUND
Andrew J. Kemmerer and Joseph A. Benigno 9 Mar. 1973 11 p refs Presented at ERTS-1 Symp., New Carrollton, 5-9 Mar. 1973 Original contains color imagery. Original photography may be purchased from the EROS Data Center, 10th and Dakota Avenue, Sioux Falls, S. D. 57198
(NASA Order S-70246-AG)
(E73-10580; NASA-CR-131884) Avail: NTIS HC $3.00 CSCL 08J

The author has identified the following significant results. A feasibility study to demonstrate the potential of satellites for providing fisheries significant information was conducted in the Mississippi Sound and adjacent offshore waters. Attempts were made to relate satellite acquired imagery to selected oceanographic parameters and then to relate these parameters to aircraft remotely sensed distribution patterns of resident surface schooling fishes. Initial results suggest that this approach is valid and that

the satellite acquired imagery may have important fisheries resource assessment implications.

N73-23442*# Minnesota State Planning Agency, St. Paul.
LAND USE MANAGEMENT IN MINNESOTA Progress Report, 1 Mar. - 30 Apr. 1973
Joseph E. Sizer, Principal Investigator 30 Apr. 1973 6 p ERTS
(Contract NAS5-21801)
(E73-10581; NASA-CR-131885) Avail: NTIS HC $3.00 CSCL 08B

There are no author-identified significant results in this report.

N73-23443*# Iowa Univ., Iowa City.
UTILIZING ERTS-A IMAGERY FOR TECTONIC ANALYSIS THROUGH STUDY OF BIG HORN MOUNTAINS REGION Progress Report, 16 Mar. - 15 May 1973
Richard A. Hoppin, Principal Investigator 15 May 1973 3 p ERTS
(Contract NAS5-21852)
(E73-10583; NASA-CR-131899) Avail: NTIS HC $3.00 CSCL 08E

The author has identified the following significant results. NASA-provided color composite (1048-17234) which includes the southeastern portion of the Bighorn Mountains and the western Powder River basin is of excellent quality. The considerable variations in the red hues indicate that vegetational mapping will be enhanced over the black and white. Some additional delineation of rock units can be made, particularly the Chugwater formation. Preliminary look at just received winter scenes indicates that topographic features are enhanced both due to the snow cover and to the lower sun angle.

N73-23444*# International Inst. for Aerial Survey and Earth Sciences, Enschede (Netherlands).
EVALUATION OF THE POTENTIALS OF THE ERTS TECHNIQUES FOR GEOLOGICAL MAPPING PURPOSES Progress Report, Mar. - May 1973
H. E. C. VanderMeer Mohr, Principal Investigator May 1973 5 p Sponsored by NASA ERTS
(E73-10584; NASA-CR-131900) Avail: NTIS HC $3.00 CSCL 08G

The author has identified the following significant results. Preliminary analysis of the full frame images shows the following: (1) The techniques employed were found suitable for study purposes. (2) The positional accuracy of the system corrected bulk processed MSS images is about 100-400 m. (3) Drainage is well depicted and morphotectonic features could be recognized. (4) Water bodies are clearly shown in MSS band 7. (5) Major roads, railway lines, and large towns are more or less detectable on bands 6 and 7. (6) Vegetation and agricultural areas are recognizable at many places. (7) Major rock formation boundaries, in general, are more or less clear. (8) Some of the structural trends including folded and linear structural elements are clear. (9) MSS bands 5 and 7 appear to be most useful for visual analysis. (10) Quick look analysis suggests that regional geological mapping on ERTS-1 imagery of the study area will be probably quite feasible. However, detailed analysis, visual and quantitative, on subframes, which is under progress may render more significant results.

N73-23445*# Corps of Engineers, Waltham, Mass.
THE USE OF ERTS IMAGERY IN RESERVOIR MANAGEMENT AND OPERATION Progress Report, 14 Feb. - 14 Apr. 1973
Saul Cooper and Paul Bock, Principal Investigators 21 May 1973 12 p ERTS
(NASA Order S-70256-AG)
(E73-10585; NASA-CR-131901) Avail: NTIS HC $3.00 CSCL 08H

There are no author-identified significant results in this report.

N73-23446*# Zurich Univ. (Switzerland). Dept. of Geography.
SNOW SURVEY AND VEGETATION GROWTH IN HIGH MOUNTAINS (SWISS ALPS) Progress Report
Harold Haefner, Principal Investigator [1973] 14 p Sponsored by NASA ERTS
(E73-10586; NASA-CR-131902) Avail: NTIS HC $3.00 CSCL 08L

The author has identified the following significant results. A method for mapping snow over large areas was developed combining the possibilities of a Quantimet (QTM 72) to evaluate the exact density level of the snow cover for each individual image (or a selected section of the photo) with the higher resolution of photographic techniques. The density level established on the monitor by visual control is used as reference for the exposure time of a lithographic film, producing a clear tonal separation of all snow- and ice-covered areas from uncovered land in black and white. The data is projected onto special maps 1:500,000 or 1:100,000 showing the contour lines and the hydrographic features only. The areal extent of the snow cover may be calculated directly with the QTM 720 or on the map. Bands 4 and 5 provide the most accurate results for mapping snow. Using all four bands a separation of an old melting snow cover from a new one is possible. Regional meteorological studies combining ERTS-1 imagery and conventional sources describe synoptical evolution of meteorological systems over the Alps.

N73-23447*# Pacific Southwest Forest and Range Experiment Station, Berkeley, Calif.
INVENTORY OF FOREST AND RANGE RESOURCES, INCLUDING FOREST STRESS Monthly Progress Report, 15 Mar. - 15 May 1973
Robert C. Heller, Robert C. Aldrich, Frederick P. Weber, and Richard S. Driscoll, Principal Investigators 15 May 1973 4 p Sponsored by NASA EREP
(E73-10587; NASA-CR-131903; MPR-1) Avail: NTIS HC $3.00 CSCL 02F

There are no author-identified significant results in this report.

N73-23448*# New Mexico State Bureau of Mines and Mineral Resources, Socorro.
GEOLOGIC ANALYSIS AND EVALUATION OF ERTS-A IMAGERY FOR THE STATE OF NEW MEXICO Progress Report, 15 Mar. - 14 May 1973
Frank E. Kottlowski, Principal Investigator 14 May 1973 2 p ERTS
(Contract NAS5-21861)
(E73-10588; NASA-CR-131904) Avail: NTIS HC $3.00 CSCL 08G

There are no author-identified significant results in this report.

N73-23449*# TRW Systems Group, Redondo Beach, Calif.
ERTS IMAGE DATA COMPRESSION TECHNIQUE EVALUATION Monthly Progress Report, period ending 1 Dec. 1972
Donald J. Spencer, Principal Investigator 1 Dec. 1972 1 p ERTS
(Contract NAS5-21746)
(E73-10589; NASA-CR-131905; TRW-7132.1-06) Avail: NTIS HC $3.00 CSCL 05B

There are no author-identified significant results in this report.

N73-23450*# Earth Satellite Corp., Berkeley, Calif.
MINERAL EXPLORATION POTENTIAL OF ERTS-1 DATA Progress Report, Dec. - May 1973
W. A. Brewer, Principal Investigator, M. C. Erskine, Jr., and R. O. Prindle 18 May 1973 7 p ref ERTS
(Contract NAS5-21745)
(E73-10591; NASA-CR-131907) Avail: NTIS HC $3.00 CSCL 08G

The author has identified the following significant results. Further analysis of ERTS-1 MSS imagery of Arizona has led to division of the earlier reported three major regional fault/fracture systems into eight subdivisions. These are: System A - N40E to N50E; System B - N50W; System C - N35W; System D - N65E to N75E; System E - N-E; System F - N25W average; System G - N75W average; and System H - close to E-W. Their individual significance to known porphyry coppers and correlation to the Wasatch-Jerome and Front Orogens, the Texas Zone and Basin Range topography is postulated in the report. In this study area of Arizona the ERTS-1 mapped structural trends confirm and greatly extend some concepts of porphyry copper distribution based on prior geologic knowledge of major structural trends.

N73-23451*# National Oceanic and Atmospheric Administration, Miami, Fla. Environmental Research Labs.

REMOTE DETECTION OF OCEANIC EDDIES IN THE LESSER ANTILLES USING ERTS-1 DATA Progress Report
Kirby J. Hanson, Principal Investigator 4 Dec. 1972 2 p ERTS
(NASA Order S-70246-AG-1)
(E73-10592; NASA-CR-131908) Avail: NTIS HC $3.00 CSCL 13C

There are no author-identified significant results in this report.

N73-23452*# Environmental Research and Technology, Inc., Lexington, Mass.
EVALUATE THE APPLICATION OF ERTS-A DATA FOR DETECTING AND MAPPING SEA ICE Bimonthly Progress Report, 28 Feb. - 10 May 1973
James C. Barnes, Principal Investigator 24 May 1973 9 p ERTS
(Contract NAS5-21802)
(E73-10595; NASA-CR-131911; ERT-P-408-5; BMPR-4) Avail: NTIS HC $3.00 CSCL 08L

The author has identified the following significant results. Generally good agreement has been observed between the location of ice edges and ice concentrations as indicated on aerial observation charts and as mapped from ERTS-1 imagery. Moreover, ice surface features reported to be ridges and thaw holes are readily detected in the ERTS-1 imagery. Reported hummocks, puddles, frozen puddles, and rafted ice are not as readily detected in the imagery, although brightness variations on some ice surfaces can be distinguished, thereby suggesting their presence. In the ERTS-1 imagery, although dark new ice and nilas are difficult to detect, other younger forms of ice can be mapped and can usually be distinguished from older ice because of their lower, more uniform reflectance. A preliminary examination of the initial sample of ERTS-1 imagery collected during the spring, during the season of maximum ice extend, indicates several ice features of interest. Compact pack ice can be distinguished from coastal fast ice, and many leads can be mapped, even in the mid-Beaufort Sea. Several leads have distinct variation in reflectance.

N73-23453*# Kansas Univ./Center for Research, Inc., Lawrence. Remote Sensing Lab.
INTERPRETATION AND AUTOMATIC IMAGE ENHANCEMENT FACILITY Progress Report, Aug. 1972 - Jan. 1973
R. M. Haralick, Principal Investigator and Sam Shanmugan Jan. 1973 9 p ERTS
(Contract NAS5-21822)
(E73-10596; NASA-CR-131912) Avail: NTIS HC $3.00 CSCL 14B

The author has identified the following significant results. Efforts to provide data processing support for ERTS-1 investigators in Kansas are summarized. Programs have been developed for data retrieval, feature extraction, and classification of digital MSS data. The IDECS/PDP-15 facility at the University of Kansas Remote Sensing Laboratory has been used for quick look analysis of ERTS-1 imagery. Programs have been developed for studying fresh water bodies in ERTS-1 imagery over Kansas on the IDECS.

N73-23454# National Oceanographic Data Center, Washington, D.C.
USER'S GUIDE TO NODC'S DATA SERVICES
Feb. 1973 77 p
Avail: SOD $1.00 Domestic Postpaid or $0.75 GPO Bookstore

The guide is prepared to help users of NODC's services formulate requests for data and related information. It describes data bases and formats in which data can be obtained, contains examples of data listings, summaries, and displays, and explains entries and codes used in printout formats. Author

N73-23455# Physical Research Lab., Ahmedabad (India).
SOME CHARACTERISTICS OF THE IONOSPHERIC IRREGULARITIES ASSOCIATED WITH E SUB S-q LAYERS
H. Chandra and R. G. Rastogi [1973] 9 p refs Submitted for publication
(AER-73-04) Avail: NTIS HC $3.00

Spaced fading records at Thumba are studied at times when E sub s-q disappears following large changes in the geomagnetic H component. The results for the periods when E sub s-q is present are known to show fast fading, westward drift and highly elongated ground diffraction patterns with small semiminor axis. During periods of no E sub s-q condition, the fadings are found to be very slow; the drift direction is reversed to the east and the ground diffraction pattern becomes almost isotropic with a large semi-minor axis whose alignment is a few degrees off the magnetic N-S direction. The characteristics of the fading, and those of the ground diffraction pattern when E sub s-q disappears are similar to the characteristics usually obtained at latitudes well away from the equator. The E sub s-q is thus suggested to be a super-position of additional irregularities over the normal E region irregularities (similar to those in the E region at nonequatorial latitudes). Author

N73-23456# Kyoto Univ. (Japan).
CATALOGUE OF DATA IN THE WORLD DATA CENTRE C2 FOR GEOMAGNETISM
Mar. 1973 29 p
Avail: NTIS HC $3.50

Included in this catalog are data on: (1) geomagnetic stations; (2) status of data collection; (3) station indexes; and (4) distribution of the stations. A.L.

N73-23457# Technische Universitaet, Brunswick (West Germany). Inst. fuer Geophysik und Meteorologie.
GEOPHYSICAL STUDIES AND REPORTS FROM METEOROLOGY AND ASTROPHYSICS COMPUTER PROGRAMS FOR PROCESSING AZUR MAGNETOMETER DATA [RECHNERPROGRAMME ZUR VERABEITUNG DER AZUR-MAGNETOMETERDATEN]
Burkhard Theile 1972 172 p refs In GERMAN
(GAMMA-17-167S) Avail: NTIS HC $10.75

A system for the collection and processing of magnetometer data received by telemetry from artificial satellites is discussed. The configurations of the satellite and the magnetometer are presented. The nature of the magnetometer experiment is described. The format of the telemetered data is outlined. The computer flow diagrams for processing the data and the required computer programs are reported. Transl. by P.N.F.

N73-23458# Astronomisches Inst., Bonn (West Germany).
DENSITY FLUCTUATIONS IN THE UPPER ATMOSPHERE DURING MAGNETIC DISTURBANCES AT HEIGHTS FROM 250 TO 800 km [DICHTESCHWANKUNGEN DER HOCHATMOSPHAERE WAEHREND GEOMAGNETISCHER STOERUNGEN IM HOEHENBEREICH 250 BIS 800 km]
Max Roemer 1972 75 p refs In GERMAN
(Rept-85) Avail: NTIS HC $5.75

More than 200 density fluctuations following geomagnetic disturbances, derived from drag data of the Explorer 1, Explorer 9, Injun 3, Explorer 17, Explorer 19, and Explorer 24 satellites were used to deduce the reaction time of the upper atmosphere and the amplitude of the density variation. The altitude range from 250 to 800 km is covered by the data in the time interval 1961 through 1966. The results on the time lag are compared in detail with results by Jacchia et al.(1967). In addition to the standard extrema procedure an integral method is used to determine the delay time giving the same result for the average time lag. Author

N73-23459# Physical Research Lab., Ahmedabad (India).
COUNTER EQUATORIAL ELECTROJET CURRENTS IN INDIAN ZONE
R. G. Rastogi [1973] 11 p refs Submitted for publication
(AER-73-03) Avail: NTIS HC $3.00

The phenomenon of afternoon depression of the geomagnetic H field is described on quiet days near the magnetic equator in the Indian zone. These events occur most frequently around 1600 solar hour and are localized in longitude; sometimes, not seen at stations separated by even two hours local time. The geomagnetic disturbance tends to decrease or destroy the identity of the phenomenon. The latitudinal extent of these events is confined to the equatorial electrojet region. The events do not seem to be caused mainly by the moon, but their occurrences are modified by the lunar age, being most frequent around the new and full moon. These events are associated with the disappearance of the q type of e sub s over the equator for periods during which the H field is below the nighttime level. The currents responsible for these events flow westward in the

E-region within a few degrees centered near the magnetic equator. Author

N73-23460# Ionosphaeren-Institut Breisach (West Germany).
IONOSPHERE DATA, VERTICAL-ECHO-SOUNDING: FREIBURG, URSI-CODE-131, JANUARY 1973 [IONOSPHAEREN-DATEN, VERTIKAL-ECHO-LOTUNG: FREIBURG, URSI-CODE 131, JANUARY 1973]
Jan. 1973 44 p In GERMAN and FRENCH
(Rept-319-F) Avail: NTIS HC $4.25

Daily summaries are presented for vertical echo sounding of the upper atmosphere during January, 1973. The data include charts of median values for the E and F regions. Author

N73-23461# Ionosphaeren-Institut Breisach (West Germany).
IONOSPHERE DATA, VERTICAL-ECHO-SOUNDING: FREIBURG, URSI-CODE 131, DECEMBER 1972 [IONOSPHAEREN-DATEN, VERTIKAL-ECHO-LOTUNG, FREIBURG, URSI-CODE 131, DECEMBER 1972]
Dec. 1972 44 p In GERMAN and FRENCH
(Rept-318-F) Avail: NTIS HC $4.25

Daily summaries are presented for vertical echo sounding of the upper atmosphere during December, 1972. The data include charts of median values for the E and F regions. Author

N73-23462# RAND Corp., Santa Monica, Calif.
A JOSS PROGRAM FOR THE GEODETIC INVERSE COMPUTATION
P. A. Smith and H. G. Massey Jan. 1973 29 p refs
(P-4950) Avail: NTIS HC $3.50

The JOSS Program described computes the geodetic distance and the azimuths between two geodetic positions referred to an ellipsoid of revolution. Provision is made for using parameters of the ellipsoid other than those set in the program. Author

N73-23463# Lockheed Missiles and Space Co., Palo Alto, Calif.
ANALYTICAL MODEL OF A GEOMATIC SURVEY FROM THE KOSMOS-321
Sh. Sh. Dolginov, N. A. Zhuravleva, A. N. Pushkov, L. O. Tiurmina, and T. N. Cherevko [1973] 2 p refs Transl. into ENGLISH from Geomagnetizm i Aeronomiya (Moscow), v. 13, no. 1, 1973 p 196-197
Avail: NTIS HC $3.00; National Translations Center, John Crerar Library, Chicago, Ill. 60616

The mission of the Cosmos-321 satellite is reported. The onboard cesium magnetometer measured the geomagnetic field vector every 2 seconds of flight. A spherical harmonic analysis of the geomagnetic survey was executed by an iteration method. The POGO 8/69 model, reduced to the 1970 epoch, was taken as the zero approximation. Measurements for every 20 seconds of flight, 12,000 points in all, were used to obtain the analytical model of the field. Author

N73-23464# Lockheed Missiles and Space Co., Palo Alto, Calif.
IONOSPHERE INVESTIGATIONS CONDUCTED BY USING THE INTERKOSMOS-2, 1
K. I. Gringavz, K. B. Serafimov, K. G. Shmelovskii, and Ia. Shmilauer [1973] 7 p refs Transl. into ENGLISH from Kosmich. Issled. (Moscow), v. 11, no. 1, 1973 p 95-100
Avail: NTIS HC $3.00; National Translations Center, John Crerar Library, Chicago, Illinois 60616

Fundamental data about the Interkosmos-2, the scientific apparatus, the organization of the whole experiment and the processing of the obtained data are presented. Experiments with spherical ion traps, cylindrical Langmuir probes, a high-frequency electron temperature probe, and a two-frequency coherent radiowave transmitter were conducted on the satellite. The general characteraretics of the measurement results are presented. Author

N73-23465# Commonwealth Scientific and Industrial Research Organization, Melbourne (Australia). Div. of Atmospheric Physics.
[ATMOSPHERIC RADIATION, LABORATORY MODELS, AIR-SEA INTERACTION, AND CARBON DIOXIDE MONITORING FOR ATMOSPHERIC PHYSICS STUDY] Annual Report
1972 57 p refs
Avail: NTIS HC $5.00

The research projects of an Australian atmospheric physics laboratory are presented. The subjects discussed are: (1) dynamical and synoptic meteorology; (2) atmospheric radiation; (3) micrometeorology; (4) quality of the environment; (5) ozone; (6) airglow; (7) agricultural; and (8) cloud physics. Author

N73-23466# Illinois Univ., Urbana. Ionosphere Radio Lab.
A STUDY OF NONLINEAR ATMOSPHERIC WAVES
HanRu Cho Sep. 1972 107 p refs
(Contract NSF GA-13723)
(TR-48) Avail: NTIS HC $7.50

Criteria are established to distinguish between weak and strong nonlinear effects. Various weak and strong nonlinear phenomena are classified. In particular, the resonant wave-wave interaction of acoustic-gravity waves, the nonlinear dispersive effects on the propagation of gravity waves, and the possibility of long waves in the upper atmosphere are treated with some care. Some aspects of the strong nonlinear phenomena are also discussed. Author

N73-23467*# National Aeronautics and Space Administration. Goddard Space Flight Center, Greenbelt, Md.
ANALYSIS OF SOME METHODS FOR OBTAINING SEA SURFACE TEMPERATURE FROM SATELLITE OBSERVATIONS
John C. Price Apr. 1973 23 p refs
(NASA-TM-X-66235; X-651-73-108) Avail: NTIS HC $3.25

Satellite measurements of sea surface temperature must be corrected for atmospheric moisture, cloud contamination, reflected solar radiation and other sources of error. Procedures for reducing errors are discussed. It appears that routine accuracies of 1 C are possible, given low noise spectral measurements in the infrared. Author

N73-23468*# National Aeronautics and Space Administration. Goddard Space Flight Center, Greenbelt, Md.
ERTS-1 APPLICATIONS IN HYDROLOGY AND WATER RESOURCES
V. V. Salomonson and A. Rango May 1973 25 p refs Presented at 93d Ann. Conf. of the Am. Water Work Assoc., 13-18 May 1973
(NASA-TM-X-66237; X-650-73-131) Avail: NTIS HC $3.25 CSCL 08H

After having been in orbit for less than one year, the Earth Resources Technology Satellite (ERTS-1) has shown that it provides very applicable data for more effective monitoring and management of surface water features over the globe. Mapping flooded areas, snowcover, and wetlands and surveying the size, type, and response of glaciers to climate are among the specific areas where ERTS-1 data were applied. In addition the data collection system has proven to be a reliable tool for gathering hydrologic data from remote regions. Turbidity variations in lakes and rivers were also observed and related to shoreline erosion, industrial plant effluent, and overall water quality. Author

N73-23469*# Scripta Technica, Inc., Washington, D.C.
PROBLEMS OF TERRESTRIAL GLACIATION AND CYCLES IN NATURE. CHAPTER 9: CYCLES ON THE EARTH AND IN THE UNIVERSE
Ye. V. Maksimov Washington NASA May 1973 24 p refs Transl. into ENGLISH from the book "Problemy Oledeneniya Zemli i Ritmy v Prirode" Leningrad, Nauka Press, 1972 p 250-268
(Contract NASw-2484)
(NASA-TT-F-14827) Avail: NTIS HC $3.25 CSCL 08D

The idea is advanced that glaciation cycles are related to cosmic rhythms. Evidence of such correlatable rhythms is seen in meteorite activity, number of observed comets, solar activity cycles, the rings of Saturn, stellar novae, and geochronological data. Author

N73-23470*# National Aeronautics and Space Administration, Washington, D.C.
MEASUREMENT OF WIND AND TEMPERATURE IN THE UPPER ATMOSPHERE
J. Villain May 1973 33 p refs Transl. into ENGLISH from Internal Notes of l'Etablissement d'Etudes et de Rech. Meteorol. (France), no. 300, 1973 23 p

(NASA-TT-F-14921) Avail: NTIS HC $3.75 CSCL 04A

The methods used to plot the wind, including the limits and the accuracy achieved are described along with an examination of the corrections which apply to the terms of the general equation of equilibrium of a thermistor. The limited values of these corrections as functions of the sounding conditions are estimated and compared among themselves to determine the most suitable methods of exploitation. Author

N73-23471*# Kanner (Leo) Associates, Redwood City, Calif.
THE KINEMATICS OF NOCTILUCENT CLOUDS
W. Schroeder Washington NASA May 1973 10 p refs Transl. into ENGLISH from Beitr. Geophys. (East Germany), v. 79, no. 3, 1970 p 229-235 Sponsored by NASA
(NASA-TT-F-14928) Avail: NTIS HC $3.00 CSCL 04A

Early and recent measurements performed on noctilucent cloud waves are discussed. While wind discontinuities at the mesopause are responsible for the shorter wavelengths, it is assumed that the longer wavelengths are caused by gravitational waves. Measurements made at Ronnebeck indicate wavelengths between 9 and 50 km; the general direction of noctilucent cloud movement is SW at a velocity of about 35 to 55 m/s. Author

N73-23472*# National Aeronautics and Space Administration. Ames Research Center, Moffett Field, Calif.
EARTH RESOURCES GROUND DATA HANDLING SYSTEMS FOR THE 1980'S
Edgar M. VanVleck, Kenneth F. Sinclair, Samuel W. Pitts, and Robert E. Slye Mar. 1973 151 p refs
(NASA-TM-X-62240) Avail: NTIS HC $9.75 CSCL 05B

The system requirements of an operational data handling system for earth resources in the decade of the 1980's are investigated. Attention is drawn to problems encountered in meeting the stringent agricultural user requirements of that time frame. Such an understanding of requirements is essential not only in designing the ground system that will ultimately handle the data, but also in design studies of the earth resources platform, sensors, and data relay satellites which may be needed. Author

N73-23473# Ludwig-Maximilians-Universitat, Munich (West Germany). Fakultaet fuer Geowissenschaften.
OBSERVATIONAL RESULTS FROM THE EARTH MAGNETIC OBSERVATORY FUERSTENFELDBRUCK FOR THE YEAR 1972 [ERGEBNISSE DER BEOBACHTUNGEN AM ERD-MAGNETISCHEN OBSERVATORIUM FUERSTENFELD-BRUCK IM JAHRE 1972]
1973 58 p In GERMAN *Its* Munich Univ. Bull., Ser. A, No. 15
Avail: NTIS HC $5.00

Geophysical observations conducted by the observatory at Fuerstenfeldbruck, Germany during 1972 are presented. Hourly, daily, and monthly variations in the horizontal and vertical components of the earth magnetic field are reported. Data on earth magnetic pulsations and earth currents are tabulated.
Transl. by P.N.F.

N73-23474# Maritime Safety Agency, Tokyo (Japan).
DATA REPORT OF HYDROGRAPHIC OBSERVATIONS. SERIES OF MAGNETIC SURVEY, NO. 2: MAGNETIC SURVEY OF JAPAN, 1969 - 1970
Mar. 1973 224 p
(Pub-592) Avail: NTIS HC $13.25

Results are presented of a geomagnetic survey conducted in and around Japan from July 1969 until November 1970. The special magnetometric equipment employed on board the YS-11 aircraft is described by means of specifications and photographs. The data appear in the form of seven types of magnetic charts, in addition to tables which specify times and dates of the observed geomagnetic values. J.M.M.

N73-23475# Maritime Safety Agency, Tokyo (Japan).
DATA REPORT OF HYDROGRAPHIC OBSERVATIONS. SERIES OF GEOMAGNETISM, NO. 7: THE RESULTS OF MAGNETIC OBSERVATIONS FOR THE YEAR 1967 - 1969
Feb. 1973 292 p
(Pub-591) Avail: NTIS HC $16.75

Report is made of magnetic observations made at the Simosato Magnetic Observatory from 1967 to 1969. The results, which appear in tabular and graphic form, include special magnetic data compiled during post-IQSY and IASY. J.M.M.

N73-23476# Utrecht State Univ. (Netherlands). Vening Meinesz Lab.
GEOPHYSICAL INVESTIGATIONS OFF THE SURINAM COAST
B. J. Collette, J. A. Schouten, K. W. Rutten, D. J. Doornbos, and W. H. Staverman 1971 30 p refs
(SP-6) Avail: NTIS HC $3.50

The results are given of a geophysical survey (seismics, magnetics, gravity) off the Surinam coast. This survey was planned in addition to the previous gravity and magnetic measurements, and covers both the Continental Shelf and the adjoining Guiana marginal plateau. A total of 8 continuous seismic reflection profiles have been made. These profiles show a large accumulation of prograding sediments. The gravity measurements made on 5 of the 8 tracks indicate, however, that this description of the plateau is inadequate with regard to the structure of the underlying crust. Either the Guiana plateau is lying over a slab of continental crust, or a huge thickness of sediment is present accounting for the mass deficiency. To explain the isostatic overcompensation, a process affecting the equilibrium position of the continental margin is assumed. A further study of the problems is presented which includes an evaluation of the magnetic results. Author

N73-23477# Lockheed Missiles and Space Co., Palo Alto, Calif.
ELECTRON FLUXES WITH GREATER THAN APPROXIMATELY 80 Mev ENERGIES AT THE EQUATOR FROM RESULTS OF MEASUREMENTS ON THE KOSMOS-490
R. N. Basilova, N. L. Grigorov, L. F. Kalinkin, G. P. Pugacheva, E. A. Spriakhin, and I. A. Savenko [1973] 2 p refs Transl. into ENGLISH from Kosmich. Issled. (Moscow), v. 11, no. 1, 1973 p 160-161
Avail: NTIS HC $3.00; National Translations Center, John Crerar Library, Chicago, Illinois 60616

A device aboard the Cosmos 490 satellite is described which measures large fluxes of electrons. It consists of two telescopes, a scintillation calorimeter, a Cerenkov counter with a plexiglass radiator, and two scintillation counters. A lead filter alternately covers the apertures of the telescopes with a 1.5 hr exposure time for each telescope. The number of electrons recorded by the device is determined by the difference between the readings with and without the filter, taking into account the dependence of the recording efficiency on the electron energy determined in the calibrating process. J.M.M.

N73-23478*# Kanner (Leo) Associates, Redwood City, Calif.
SOME OBSERVATIONS OF NIGHT SKY LUMINESCENCES IN THE UPPER ATMOSPHERE DURING IQSY (1964/65)
W. Schroeder Washington NASA May 1973 9 p refs Transl. into ENGLISH from Beitr. Geophysik (Leipzig), v. 80, no. 1, 1971 p 61-64
(Contract NASw-2481)
(NASA-TT-F-14927) Avail: NTIS HC $3.00 CSCL 04A

A list of dates and times of the sightings of increased night sky luminescences in the upper atmosphere is presented. Particular note is made of the fact that maximum luminous phenomena in the atmosphere coincide with a minimum of sunspot activity and vice versa. Author

N73-23479*# Colorado State Univ., Fort Collins.
A FEASIBILITY STUDY OF USING REMOTELY SENSED DATA FOR WATER RESOURCE MODELS
James F. Ruff Feb. 1973 35 p refs
(Contract NAS8-28590)
(NASA-CR-129001) Avail: NTIS HC $3.75 CSCL 08H

Remotely sensed data were collected to demonstrate the feasibility of applying the results to water resource problems. Photographs of the Wolf Creek watershed in southwestern Colorado were collected over a one year period. Cloud top temperatures were measured using a radiometer. Thermal imagery of the Wolf Creek Pass area was obtained during one pre-dawn flight. Remote sensing studies of water resource problems for user agencies were also conducted. The results indicated that: (1) remote sensing techniques could be used to assist in the solution of water resource problems; (2) photogrammetric determination of snow depths is feasible; (3) changes in turbidity

or suspended material concentration can be observed; and (4) surface turbulence can be related to bed scour; and (5) thermal effluents into rivers can be monitored. Author

N73-23480# Miami Univ., Fla. Rosentiel School of Marine and Atmospheric Science.
CLOUD PHYSICS RESEARCH Final Report, 1 Jan. - 31 Dec. 1971
H. V. Senn Mar. 1973 37 p refs
(Contracts N-22-134-72(N); E-22-62-71(N))
(UM-RSMAS-73029) Avail: NTIS HC $4.00

The vertical and horizontal growth rates of some of the precipitating clouds which were seeded over Florida in the 1971 NOAA experiments were studied using filmed data from two radars. The vertical growth rates were comparable to those found by others; however, the horizontal growth of individual echoes often did not coincide in time with changes in vertical. The relationship between maximum echo area and precipitation rate were only weakly related, that between area and height was somewhat better; and height was much more closely related to rain rate. Author

N73-23481# Geological Survey, Washington, D.C.
INTERPRETATION OF AN AEROMAGNETIC SURVEY OF THE AMCHITKA ISLAND AREA, ALASKA
G. D. Bath, W. J. Carr, L. M. Gard, Jr., and W. D. Quinlivan 1972 70 p refs Sponsored by AEC Original contains color illustrations
(USGS-PP-707; LC-70-189816) Avail: SOD $1.75

An aeromagnetic survey of about 1,800 square miles of Amchitka Island and the adjacent insular shelf has provided information on tertiary volcanic, intrusive, and sedimentary rocks. This includes identification of rocks that cause anomalies and the lateral extents, structures, and approximate depths of those rocks. Near proposed drill sites, anomalies were examined for features that might be related to faulting. The survey was facilitated by data on the magnetic properties of 347 rock specimens collected from surface exposures and 216 from drill cores and by plots of 25 miles of ground magnetic traverse. The data on magnetic properties furnished bases on which anomalies were related to geologic features; ground surveys classified near-surface rocks as either lava or breccia are also included. Author

N73-23482# Illinois Univ., Urbana. Aeronomy Lab.
IMPROVED CALIBRATION OF INCOHERENT-SCATTER ELECTRON DENSITIES FROM IONOGRAMS
R. J. Slightam and S. A. Bowhill 1 May 1973 158 p refs
(Grant NSF GA-27295)
(UILU-ENG-73-2503; Aeronomy-53) Avail: NTIS HC $10.00

An improved technique is developed using ionosonde virtual-height observations and virtual-height calculations based on a first-order electron density profile deduced from incoherent scatter. The theory of incoherent scatter and the magnetoionic theory applicable to ionogram synthesis are presented. Virtual heights are calculated from continuous model electron density profiles with no magnetic field as well as discrete electron density profiles with the magnetic field included. An iteration scheme is developed to renormalize incoherent-scatter power-profile data at a selected frequency. The analysis is applied to profiles obtained during the solar eclipse of Mar. 1970; a refined plot of foF2 is obtained, and calculated ionograms are deduced. The inonosonde and incoherent-scatter measurement techniques are compared. Author

N73-23483*# Ohio State Univ. Research Foundation, Columbus. Dept. of Geodetic Science.
QUADRATURE ERRORS IN THE PARTICAL DERIVATIVES REQUIRED FOR THE DIRECT RECOVERY OF GRAVITY ANOMALIES FROM SATELLITE OBSERVATIONS
D. P. Hajela Dec. 1972 39 p refs
(Grant NGR-36-008-161; OSURF Proj. 3210)
(NASA-CR-130240; Rept-189) Avail: NTIS HC $4.00 CSCL 08E

The equations of motion of a geodetic satellite in the earth's gravitational field expressed by gravity anomalies require the evaluation, amongst others, of the partial derivatives of the disturbing force with respect to individual gravity anomalies. Data are discussed on how anomaly blocks should be subdivided so that the partial derivatives may be numerically evaluated for each subdivision, and then finally meaned to give the value representative of the whole blocks, with accuracies better than 2 to 3 percent for all blocks. The number of subdivisions is large for the blocks nearest to the satellite subpoint and decreases away from it. The actual values of this spherical distance and the actual subdivision of the mean gravity anomaly blocks was determined numerically for 184 15 deg x 15 deg equal area blocks. Satellite heights above the earth of 400 km, 800 km and 1600 km were considered. The computer times for the suggested scheme were compared with alternative solutions. Author

N73-23484# Societe d'Etudes Techniques et d'Entreprises Generales, Leplessis-Robinson (France).
EARTH RESOURCES AIRCRAFT FACILITY. VOLUME 1: PROJECT SUMMARY Final Report [EARTH RESOURCES AIRCRAFT FACILITY. VOLUME 1: SOMMAIRE DE L'ETUDE RAPPORT FINAL]
[1972] 87 p refs In FRENCH 8 Vol.
(Contract ESTEC-1517/EL)
(ESRO-CR(P)-117) Avail: NTIS HC $6.50

Results of a study on the mission planning for a European earth resources survey aircraft are summarized. They include choice of mission, analysis of payload, choice of aircraft, technical feasibility, initial operational program, and juridical aspects of the Earth Resources Aircraft Facility project. ESRO

N73-23485# Naval Postgraduate School, Monterey, Calif.
AN OPTICAL APPARATUS TO DETERMINE THE EFFECT OF TURBULENCE ON THE MODULATION TRANSFER FUNCTION OF THE ATMOSPHERE M.S. Thesis
Wayne Thompson Hildebrand Dec. 1972 44 p refs
(AD-757256) Avail: NTIS CSCL 04/1

An apparatus was designed and constructed to determine the effect of atmospheric turbulence on the modulation transfer function (MTF) of the atmosphere. A reflecting telescope and reticle system provided optical information in the visible region to a silicon photodiode detector which was responsive from .35 micron to 1.1 microns. The output of the detector was processed to measure irradiance modulation from a target of known spatial frequency. The modulation transfer function of the atmospheric transmission medium and the optical system was measured under calm conditions and conditions of turbulence on a 270 meter round trip path through a building corridor. The optical apparatus described was capable of detecting, in the visible range, the degrading effect of turbulence on MTF. All reflective optics were used so that the visual through 10 micrometers range can be covered with use of different detectors. Author (GRA)

N73-23486# Radiation Research Associates, Inc., Fort Worth, Tex.
MONTE CARLO STUDIES OF LIGHT TRANSPORT THROUGH NATURAL ATMOSPHERES Final Report, 1 Feb. 1970 - 31 Dec. 1972
Wolfram Blattner and Michael B. Wells 31 Jan. 1973 107 p refs
(Contract F19628-70-C-0156; AF Proj. 7621)
(AD-757494; RRA-T7304; AFCRL-TR-73-0109) Avail: NTIS CSCL 04/1

The report describes work performed on six major work areas: Modification to the FLASH procedure and its application to solar almucentar, horizon brightness, and twilight scattering studies; Development of the BRITE procedure for treating light scattering in a plane parallel atmosphere with the backward Monte Carlo method. Application of the FLARE procedure to evaluate the effect of multiple scattering on the angular intensity reaching a receiver from a point isotropic source; Modifications of the LITE-IV procedure for use in path radiance and path reflectance calculations; Applications of the TPART-I procedure to studies of radiation transport in foggy atmospheres for use in determining the effects of scattering on visibility measurements made with optical transmission instruments; and, Modifications to the MIE2 procedure and development of the MIE3, MIE4, and MIE5 procedures for calculating scattering cross sections and phase function data for homogeneous spherical particles and for particles having a spherical shell of different materials, and the application

of these programs to calculations of scattering data for visible and infrared light. (Author Modified Abstract) GRA

N73-23487# National Committee for Space Research, Haifa (Israel). Radio Observatory.
IONOSPHERIC RESEARCH USING SATELLITES Final Scientific Report, 1 Feb. 1969 - 31 Dec. 1971
Jonathan Mass, Israel Keroub, and Abraham Huval Feb. 1972 69 p refs
(Contract F61052-69-C-0017; AF Proj. 4643)
(AD-757498; AFCRL-TR-73-0019) Avail: NTIS CSCL 20/14

The report completes two Annual Scientific Reports (1969, 1970) on the study of the ionosphere using satellites. The ray tracing program used to study ionospheric effects on satellite signals is described in some detail and examples given. The accuracy of graphical methods usually used was found to be better than 7% in a difficult case and the results were not very sensitive to the medium altitude used. A method to detect the satellite's spin for the correction of Faraday data was developed. It is based on accurately determining the changes in the polarization parameters, using the Poincare sphere concept. The contribution of the TEC (Total Electron Content) and its gradients to errors in a satellite navigation system (NNSS) were determined. These depend on the geometry of the pass relative to the station. Computed results are shown graphically and the results are interpreted. Author (GRA)

N73-23488# Aerospace Corp., El Segundo, Calif. Lab. Operations.
WHISTLER-DUCT FORMATION: A MAGNETOSPHERIC INSTABILITY Technical Report, Apr. - Sep. 1972
Michael Schulz and Harry C. Koons 18 Dec. 1972 14 p refs
(Contract F04701-72-C-0073)
(AD-756461; TR-0073(3260-20)-15; SAMSO-TR-73-41) Avail: NTIS CSCL 04/1

Magnetospheric ducts that guide very-low-frequency (VLF) radiation are subject to spontaneous intensification by a linear instability that arises from the coupling between the magnetosphere and the ionosphere. The elements of this instability comprise a localized enhancement of electron precipitation and a field-aligned column of enhanced plasma density, each in turn causing the other. This interaction can create fully developed plasmaspheric ducts spontaneously from infinitesimal fluctuations. A whistler duct thus formed attains saturation (nonlinear stabilization) by virtue of ionospheric recombination and the bounded supply of electrons available for precipitation.
Author (GRA)

N73-23489# Lockheed Missiles and Space Co., Palo Alto, Calif. Research Lab.
INSTITUTE PROCEEDINGS, PHYSICS AND CHEMISTRY OF UPPER ATMOSPHERES Final Summary Report
Billy M. McCormac and Robert Varney Feb. 1973 71 p refs Conf. held at Orleans, France, 31 Jul. - 11 Aug. 1972
(Contract N00014-72-C-0404)
(AD-756812; LMSC-D311471) Avail: NTIS CSCL 04/1

The Advanced Study Institute discussed the diverse aspects of atmospheric research inherent in the considerable array of diversified disciplines involved in order to achieve a unified and current understanding of the atmospheres of the earth as well as the nearer planets. The paper is a summary of some of the significant findings reported at the Institute. Topics discussed include: Structure and composition of the atmosphere; Physical processes; Chemical processes and models; Experimental results and interpretations; Other planets. GRA

N73-23490# Danish Meteorological Inst., Copenhagen. Geophysical Dept.
IONOSPHERIC RESEARCH USING SATELLITES Interim Scientific Report, 1 Nov. 1971 - 31 Oct. 1972
Ib Stein Mikkelsen 31 Dec. 1972 12 p refs
(Grant AF-AFOSR-2161-72; AF Proj. 4643)
(AD-756483; AFCRL-TR-73-0083; ISR-1) Avail: NTIS CSCL 04/1

The report reviews research carried on at Narssarssuaq, Greenland as follows: scintillation-measurements on the signal from the geostationary satellite ATS-3 (137 MHz); total electron/content-measurements, also from the ATS-3 satellite (137 MHz); scintillation-measurements on signals from the geostationary satellite LES-6 (254 MHz); Overhead passes of the Nimbus-4 satellite, giving scintillation recordings; and during shorter periods, recordings have been made of the two Solar Radiation Satellites, the SOLRAD-9 and the SOLRAD-10. GRA

N73-23491# Arcon Corp., Wakefield, Mass.
MATHEMATICAL AND STATISTICAL ANALYSIS FOR THE REDUCTION OF IONOSPHERIC DATA AND OTHER PHYSICAL SYSTEMS
Manfred Friedman, David C. Miller, Krishna S. Vanguri, Joseph Gibbs, and Jean Hsiung Nov. 1972 136 p refs
(Contract F19628-71-C-0034)
(AD-757480; AFCRL-TR-73-0049; SR-2) Avail: NTIS CSCL 04/1

The authors describe work involved in the analysis and modeling of ionospheric data collected at various places around the globe. This involved correlation studies, regression analysis, fitting nonlinear time series and contour plotting. The authors helped develop a computer package for modeling the polar ionosphere. In addition, they prepared some efficient ray tracing programs, worked on problems for sunspot analysis, reduced and analyzed satellite measurements of electron densities in the ionosphere, and prepared theoretical and numerical solutions of electron transport characteristics in an irradiated solid. (Author Modified Abstract) GRA

N73-23492# TRW Systems Group, Redondo Beach, Calif.
COMPUTER SIMULATION OF ION COLLECTION BY AN IONOSPHERIC PROBE Final Report, 1 Dec. 1971 - 1 Jan. 1973
Frank W. Vogenitz 1 Jan. 1973 83 p refs
(Contract F19628-72-C-0130; AF Proj. 6687)
(AD-757481; TRW-20982-6001-RU00; AFCRL-TR-73-0006) Avail: NTIS CSCL 04/1

Monte Carlo calculations of positive ion collection by a flat faced cylindrical probe were carried out at speed ratio 1.5 over a range of (lambda sub infinity)/D (neutral molecule mean free path/cylinder diameter) and (lambda sub D)/D (Debye length/D) at a fixed cylinder front face potential of -10 volts. Under collisionless conditions (lambda sub infinity) = D) it was found that for (lambda sub D)/D = 1.0 the ion flux to the front face stagnation point was approximately 35 times the field-free ion flux. The stagnation point ion flux decreased rapidly as (lambda sub D)/D was reduced below 1.0, reaching a value of approximately 4 times the field free ion flux at lambda sub D/D = .03, when scaled to conditions for which flight data were available was found to be a factor of 4 higher than the flight measured flux. (Author Modified Abstract) GRA

N73-23493# IIT Research Inst., Chicago, Ill.
CHEMICAL COMPOSITION OF THE ATMOSPHERE AT 40,000 - 65,000 FEET USING A MODIFIED MATRIX ISOLATION TECHNIQUE Semiannual Report, 1 Aug. 1972 - 31 Jan. 1973
Alan Snelson 2 Feb. 1973 47 p refs
(Contract F44620-73-C-0006; AF Proj. 9750)
(AD-757533; IITRI-C6269-1; AFOSR-73-0487TR) Avail: NTIS CSCL 04/1

In the near future commercial aircraft (SST's) will be in routine schedule operation. Environmental experts have exhibited a variety of concerns over possible adverse effects the effluents from such flights may have upon the earth's climate. Unfortunately many of these prognostications are based on rather sketchy data as to the normal chemical composition of the atmosphere. In the program the matrix isolation technique is to be adapted to the cryogenic sampling of the atmosphere at altitudes of 40,000 - 65,000 ft. The following species are to be monitored: H2O, H2O2, NO, NO2, N2O5, HNO3, O3, OH, HO2, CO, and CH4. The report discusses the design and construction of the cryogenic sampling system and the design and construction of a ground power support system. GRA

N73-23494# Air Force Cambridge Research Labs., L. G. Hanscom Field, Mass.
A MATHEMATICAL MODEL OF THE EVOLUTION OF RADIATION FOG
I. M. Zakharova 12 Dec. 1972 27 p refs Transl. into ENGLISH

of Tr. Inst. Eksp. Meteorol. (USSR), no. 23, 1971 p 157-175 (AD-757490; AFCRL-72-0720; AFCRL-Trans-100) Avail: NTIS CSCL 04/1

A system of equations is given which describes the evolution of radiation fog from the moment of its inception to the time of its dispersion. The coefficient of turbulent exchange is considered an unknown value, and for closing of the system, equations of the dynamics of a nonstationary stratified boundary layer are used. In the system of equations, one takes into account the radiational thermal exchange in the atmosphere and the effect of gravitational forces on the water content in the fog, and one establishes in the first approximation the relationship between macroprocesses and microprocesses. Author (GRA)

N73-23495# Pittsburgh Univ., Pa.
INTERFEROMETRIC STUDIES OF BARIUM RELEASE Final Technical Report
Manfred A. Biondi Griffiss AFB, N. Y. RADC Jan. 1973 20 p
(Contract F30602-72-C-0006; ARPA Order 1057; Proj. Secede)
(AD-757563; APP-37; RADC-TR-73-59) Avail: NTIS CSCL 04/1

The reduction of the Optical Interferometer Secede II data and the design, construction and testing of a rigid mounting cage, pressure housing and thermal housing for a 150 mm aperture Fabry-Perot interferometer are described. Consultation and assistance were provided to R. D. Hake of S.R.I. in the conversion of the interferometer magnetic tape records to ion radiance as a function of spatial scan position in the barium ion cloud. Optical absorption effects at the ion hyperfine wavelength complicate conversion of radiance to ion (and electron) column content, necessitating a radiation transport calculation. The 150 mm Fabry-Perot components were designed and constructed. The assembled instrument is found to maintain high optical resolution in an environment subject to moderate vibration and accelerations. Author (GRA)

N73-23496# Technische Hochschule, Aachen (West Germany). Forschungsstelle fuer Geophysik unc Meteorologie.
MASS TRANSFER IN THE LOWER ATMOSPHERE Final Technical Report
M. Horbert, C. DeLaRiva, and L. Jantowsky Dec. 1972 191 p
(Contract DAJA37-72-C-0490)
(AD-757692) Avail: NTIS CSCL 04/1

Starting with the second phase of the present research program on atmospheric eddy transport, the following items were delivered: eddy diffusivity at 2 different sites, over periods of several weeks, wind and (humid) temperature profiles, statistical evaluation of the dependance of eddy diffusivity on the wind and temperature profiles, theoretical studies leading to the formulae needed for the statistical evaluations, information and systems theoretical considerations leading to a realistic interpretation of the formulae and data given, and a brief introduction into the concepts of systems and information theories. Author (GRA)

N73-23497# Air Force Cambridge Research Labs., L. G. Hanscom Field, Mass.
A DISCUSSION OF THE GEOMAGNETIC INDICES Kp AND ap, 1932 TO 1971
AlLan L. Cage and Edward J. Zawalick 27 Nov. 1972 37 p refs
(AF Proj. 8601)
(AD-756828; AFCRL-ERP-423; AFCRL-72-0693) Avail: NTIS CSCL 08/14

Forty years (1 January 1932 to 31 December 1971) of geomagnetic data in terms of the indices Kp and ap were examined. The frequency distributions of these indices and their semiannual and diurnal variations are tabulated and discussed. Frequency tables were generated based on the present value of the index and the succeeding value of the index. These tables clearly demonstrate the persistent nature of Kp and ap. The use of these data as an aid in geomagnetic forecasting is also discussed. Author (GRA)

N73-23498# Aerospace Corp., El Segundo, Calif. Space Physics Lab.
A PHENOMENOLOGICAL MODEL OF GLOBAL IONOSPHERIC ELECTRON DENSITY IN THE E, F 1, AND F 2 REGIONS Final Report, May - Dec. 1972
Barbara K. Ching and Yam T. Chiu 1 Mar. 1973 52 p refs
(Contract F04701-72-C-0073)
(AD-757507; TR-0073(3260-10)-8; SAMSO-TR-73-91) Avail: NTIS CSCL 04/1

A global phenomenological model of the large scale variations of ionospheric electron density with the annual, diurnal and solar activity cycles has been constructed from monthly-averaged hourly ionospheric sounding data from some 50 stations spanning the years 1957-1970 as provided by World Data Center (A), Boulder, Colorado. The model, summarizing the data in simple empirical formulae and thus requiring little computer storage, is specifically for global thermospheric and ionospheric dynamical calculations such as ion drag, Joule heating and atmospheric dynamo effects which require electron or ion densities as essential inputs. Extensive comparison of the model with data and with other models is discussed. Author (GRA)

N73-23499# Aerospace Corp., El Segundo, Calif. Space Physics Lab.
LABORATORY STUDIES OF COLLISIONS OF ENERGETIC H(PLUS) AND H WITH ATMOSPHERIC CONSTITUENTS Final Report, Jan. - Nov. 1972
Robert J. McNeal and John H. Birely 30 Dec. 1972 158 p refs
(Contract F04701-72-C-0073)
(AD-757505; TR-0073(9260-01)-9; SAMSO-TR-73-87) Avail: NTIS CSCL 04/1

In the paper, the authors present an account of the current status of laboratory measurements applicable to the interaction of fast protons and hydrogen atoms with the earth's atmosphere. Data are also presented for some gases found in the atmospheres of other planets. After a brief discussion of recent measurements of the auroral particle energy spectra in order to define the energy range for relevant laboratory measurements, the motion of energetic protons in the atmosphere is discussed to elucidate further the cross sections and quenching processes of interest. A review of ionization experiments follows with emphasis on data acquired in the last decade. Cross sections for excitation of the atmospheric target gases and fast hydrogen projectiles are then presented. Application of the data to auroral calculations is also discussed. Author (GRA)

N73-23500# Atmospheric Sciences Lab., White Sands Missile Range, N.Mex.
MESOSCALE VARIATION OF SPECTRAL RADIANCE NEAR 15 MICROMETERS
Louis D. Duncan and Barbara J. Richart Jan. 1973 31 p refs
(DA Proj. 1T0-61102-B-53A)
(AD-757622; ECOM-5470) Avail: NTIS CSCL 04/1

The mesoscale variability of outgoing radiation at wavelengths corresponding to the Satellite Infrared Spectrometer (SIRS) channels, which are centered at 750, 734, 709, and 701/cm, has been investigated by using calculated radiances based upon measured temperature data. Temperature profiles measured from six radiosonde stations located on White Sands Missile Range (WSMR), New Mexico, were used with the radiative transfer equation to compute the radiances. Approximately 1750 temperature profiles obtained on 69 separate days were used in the study. The separation distance between pairs of stations varied from 10 to 157 km. (Author Modified Abstract) GRA

N73-23501# Naval Research Lab., Washington, D.C.
SKYLAB: SENSORS AND REMOTE SENSING IN SUPPORT OF THE EREP OCEANOGRAPHIC PROGRAM Final Report
Lionel I. Moskowitz 31 Jan. 1973 21 p refs
(AD-755715; NRL-7543) Avail: NTIS CSCL 08/3

The acquisition of numerous types of oceanographic data over broad areas of the globe from the orbiting of Skylab in mid-1973 heralds a new dimension in oceanography. Remote sensors aboard Skylab will be able to observe ocean-surface phenomena over spatial areas heretofore unobtainable by present techniques. This report describes the applications to oceanography of the various sensor systems aboard Skylab contained in the Earth Resources Experiment Package (EREP).

Data from the EREP sensor systems will encompass a broad range of the electromagnetic spectrum. As a consequence, validation of the EREP data will require obtaining correlative data using airborne remote-sensing techniques. For this purpose a C-130 aircraft belonging to the National Oceanic and Atmospheric Administration, equipped with a multitude of environmental sensor systems, will be the primary platform used. The types of surface truth necessary to support the EREP program, as well as a flight program for the C-130, will also be discussed. Author (GRA)

N73-23502# Scripps Institution of Oceanography, La Jolla, Calif.
ADVANCED OCEAN ENGINEERING LABORATORY Technical Progress Report, 1 Apr. - 31 Dec. 1972
William A. Nierenberg, Walter H. Munk, Frank E. Snodgras, Charles S. Cox, Michael C. Gregg, Carl H. Gibson, Carl A. Friehe, and F. H. Champagne 14 Feb. 1973 50 p refs
(Contract N00014-69-A-0200-6039; ARPA Order 2185)
(AD-757425; AOEL-35; SIO-Ref-73-3) Avail: NTIS CSCL 08/3

The report reflects the technical status of internal/surface wave interaction and microstructure projects conducted within the Advanced Ocean Engineering Laboratory at the Scripps Institution of Oceanography. These projects are: (1) Thermal Microstructure - to examine in detail the structure and dynamics of temperature and salinity; and (2) Atmospheric Boundary Layer - to provide an understanding of the interaction between atmospheric boundary effects and surface waves. Author (GRA)

N73-23503# Defense Mapping Agency Aerospace Center, St. Louis, Mo. Technical Translation Branch.
SOME RESULTS OF ASTRO-GRAVIMETRIC LEVELING IN THE USSR Transl. into ENGLISH from Geodez. i Kartograf. (Moscow), no. 6, 1972 p 4-8
L. P. Pellinen, O. M. Ostach, and E. M. Orlova Jan. 1973 14 p refs
(AD-755881; DMAAC-TC-1887) Avail: NTIS CSCL 08/5

The paper discusses some results of astro-geodetic leveling in the U.S.S.R. It has found wide application in the U.S.S.R because with a given accuracy of determining the quasi-geoidal heights it makes it possible to substantially increase the distance between the astro-points in comparison with astronomic leveling. Author (GRA)

N73-23504# Stanford Research Inst., Menlo Park, Calif.
DNA PROJECT 617 RADAR: AURORAL IONOSPHERIC MEASUREMENTS Final Report, 15 Nov. 1971 - 15 Nov. 1972
M. J. Baron Dec. 1972 314 p refs
(Contract DNA001-72-C-0076)
(AD-757358; DNA-3023F) Avail: NTIS CSCL 04/1

The DNA Project 617 incoherent-scatter radar has been operating at its Chatanika, Alaska location for eighteen months. This report describes the research studies pursued by SRI in 1972, including the following: Investigation of high-latitude ionospheric plasma-transport phenomena; Studies of ionospheric plasma interaction with the neutral atmosphere; Studies of auroral ionization; Correlative studies with the Homer Project 609 auroral clutter radar; Radar measurements in support of rocket-borne experiments (including ICE CAP 72); Diurnal/seasonal behavior of the auroral ionosphere; Measurements of the ionospheric effects of the August 1972 solar storm; Effects of the 10 July 1972 total solar eclipse; Investigation of ionospheric conditions responsible for spread-F. GRA

N73-23505# Minnesota Univ., Minneapolis. Hydraulic Lab.
FLOOD FORECASTING IN THE UPPER MIDWEST: DATA ASSEMBLY AND PRELIMINARY ANALYSIS Project Report No. 17
Arthur F. Pabst, C. Edward Bowers, and Donald G. Baker Jun. 1972 63 p Sponsored by Dept. of Interior
(PB-214091/1; OWRR-B-060-Minn(1)) Avail: NTIS HC $3.00 CSCL 08H

The objective of this study is the development of analytical procedures and the correlation of hydrologic data to aid in the prediction and control of spring floods in large Upper Midwest waterhseds. The study is divided into three phases. (1) The present work has involved the assembly of meteorological and hydrological data concerning past spring floods, (2) new data pertaining to floods during the contract period and (3) procurement and preliminary evaluation of selected mathematical models of watersheds. GRA

N73-23506# Alaska Univ., College. Inst. of Marine Science.
A NUMERICAL MODEL OF A FJORD ESTUARY. 1: BASIC CONSIDERATIONS AND PROPOSED FINITE DIFFERENCE SCHEMES
J. Brian Matthews Oct. 1972 75 p refs
(Contract N00014-67-A-0317-0002)
(AD-755233; R72-15) Avail: NTIS CSCL 08/8

It is desired to construct a numerical prediction model of the physical processes of circulation in a fjord estuary. A brief review of meteorological and oceanographic modeling techniques is given. The importance of special coordinate systems and choice of grid schemes are discussed. The review of previous modeling work indicates that physical boundaries and the manner in which they are treated are likely to be major new problems to be solved in coastal models. A three-dimensional ten layer model is proposed and a set of finite difference equations given. A simplification to a vertical-longitudinal fjord model is made and this set of equations is also given. Author (GRA)

N73-23507# Louisiana State Univ., Baton Rouge. Coastal Studies Inst.
PERIODICITIES IN INTERFACIAL MIXING
Lynn D. Wright, James M. Coleman, and Joseph N. Suhayda Jan. 1973 12 p refs Repr. from Coastal Studies, Bull. 7, Jan. 1973 p 127-135
(Contract N00014-69-A-0211-0003; NR Proj. 388-002)
(AD-755158; TR-133) Avail: NTIS CSCL 08/8

Freshwater effluents from river outlets spread and diffuse into ambient marine water; the interactions which take place between these water masses at and immediately seaward of the river mouth are critical in controlling the dissemination of sediment and water transported by the river. Mixing between these water masses, each characterized by differing properties, takes place in many ways and is affected by various mechanisms. These mechanisms control the outflow patterns and hence fundamentally determine the pattern of sediment dissemination, accumulation, and distribution of the bars that form at river mouths. Thus greater understanding of the behavior of the effluent plume would significantly aid charting, navigation, and similar operations in these constantly changing areas of strategic importance. The paper uses various remote-sensing techniques to analyze the behavior of the river plume under varying conditions. Author (GRA)

N73-23508# Scripps Institution of Oceanography, San Diego, Calif. Marine Physical Lab.
A GEOPHYSICAL STUDY OF THE CENTRAL ALEUTIAN ARC Ph.D. Thesis
John Allen Grow 15 Oct. 1972 118 p refs
(Contract N00014-69-A-0200-6002; Grant NSF GA-31377X; NR Proj. 260-103)
(AD-755455; SIO-Ref-72-75; MPL-U-52/72) Avail: NTIS CSCL 08/7

Seismic reflection, refraction and near bottom geophysical observations were made in the Aleutian trench near 173 deg W. The near bottom observations showed that the undisturbed sediments which form the base of the trench floor terminate abruptly at the foot of the north slope which appears to be made up of complexly deformed sediments. The most active zone of deformation between the Pacific and North American plates appears to be localized within 1 km of the base of the north slope. No fault-type features were observed on the near bottom geophysical system. Two structural models for the downgoing lithospheric model are proposed. These two models satisfy constraints imposed by gravity, seismic, refraction and earthquake location data. Author (GRA)

N73-23509# Smithsonian Astrophysical Observatory, Cambridge, Mass.
MATHEMATICAL METHODS APPLIED TO OCEAN-SURFACE TOPOGRAPHY AND SATELLITE GEODESY Semiannual Progress Report, 1 Jun. - 30 Nov. 1972
Charles A. Lundquist Dec. 1972 29 p refs

(Contract N00014-71-A-0110-0004; NR Proj. 301-049)
(AD-755486; SAPR-1) Avail: NTIS CSCL 08/5

Two specific studies are mentioned. In the first study, the transformation matrices between spherical harmonics and spherical sampling functions have been tabulated for linear spaces truncated after degrees 22 and 36. The matrix elements were calculated by evaluating analytical expressions for the transformations and their inverses. The matrices are 529 by 529 and 1369 by 1369 arrays, respectively. These matrices allow facile transformation between equivalent earth gravity models expanded in spherical harmonics or sampling functions. In the second study, spherical sampling functions can be used instead of spherical harmonic functions in a truncated series representation for the geoid or the geopotential. The spherical sampling-function representation of the geopotential has a simple relationship to the mass-layer models or mass-concentration models suggested by other investigators. The spherical reference surface on which the sampling points are arrayed can be transformed into a nearby surface such as an ellipsoid. Sampling functions defined for a set of concentric reference surfaces might provide a convenient representation for the mass distribution of the earth.

Author (GRA)

N73-23510# Defense Mapping Agency Aerospace Center, St. Louis, Mo. Technical Translation Branch.

SUGGESTION FOR AN IMPROVEMENT OF THE 1967 REFERENCE SYSTEM

Wladimir Hristow Jan. 1973 18 p refs Transl. into ENGLISH from Reseaux Continentaux, Proc. of the Intern. Symp. on Continental Networks, Sofia, 31 Aug. - 7 Sep. 1969
(AD-755418; DMAAC-TC-1892) Avail: NTIS CSCL 08/5

The 1967 Geodetic Reference System as adopted does not offer the possibility of unambiguously deriving either the earth's flattening or the formula for the normal gravity. In actuality, these data are missing: the earth's angular velocity (it is slowly decreasing), the ratio of the mass of the atmosphere to the mass of the earth, and also the coefficients J4, J6 of the higher harmonics in the potential of the earth's exterior gravitational field. Suggestions for improving this system are discussed. GRA

N73-23511# Naval Ordnance Lab., White Oak, Md.

DEEP OCEAN OPTICAL MEASUREMENT (DOOM) REPORT: BAHAMA CHANNELS AND NORTH-WESTERN ATLANTIC OCEAN Interim Report

Donald E. Matlack 20 Nov. 1972 67 p refs
(AD-757332; NOLTR-72-284) Avail: NTIS CSCL 08/10

In situ optical attenuation data obtained during Deep Ocean Optical Measurement (DOOM) program cruises D and E in 1969 are presented. Locales of operation were for Cruise D the Florida Straits and the Providence channels of the Bahama Islands and for Cruise E the western Atlantic from a coastal area off the Virginia Capes to the waters of the Sargasso Sea 300 nautical miles east of the Bahamas. Optical data presented are surface to bottom measurements of spectral attenuation coefficients at visible wavelengths in the transmission window interval and the volume scattering function at a wavelength of 436 nanometers. Subsequent measurement cruises are briefly discussed and DOOM program progress is updated. Author (GRA)

N73-23512# Massachusetts Univ., Amherst. Water Resources Research Center.

AN INVENTORY OF THE PONDS, LAKES AND RESERVOIRS OF MASSACHUSETTS, BERKSHIRE AND FRANKLIN COUNTIES

James A. McCann and Leo M. Daly 1972 142 p refs Sponsored by Bur. of Sport Fisheries and Wildlife
(OWRR Proj. A-034-Mass(1))
(PB-214116/6; Pub-10-2; W73-04069; MCFU-Contrib-25) Avail: NTIS HC $3.00 CSCL 08H

The report is an inventory of the physical, biological and land-water use characteristics of all ponds, lakes, and reservoirs over 5 acres or identified on U.S. Geological Survey topographic maps of Berkshire and Franklin Counties, Massachusetts. Data from published sources or from official files of Federal, state and regional water resources agencies were summarized, recorded on standard forms, coded, and keypunched on automatic data processing cards. The physical characteristics of the ponds were updated to include all standing bodies of water over 5 acres located on aerial photographs taken in the spring of 1965.

Author (GRA)

N73-23513# Colorado State Univ., Fort Collins. Environmental Resources Center.

SELECTION OF TEST VARIABLE FOR MINIMAL TIME DETECTION OF BASIN RESPONSE TO NATURAL OR INDUCED CHANGES Completion Report, 1 Jul. 1969 - 30 Jun. 1972

Hubert J. Morel-Seytoux Dec. 1972 21 p refs
(Contract DI-14-31-0001-3506; OWRR Proj. A-011-Colo(20))
(PB-214114/1; CER72-73HJM7; W73-04061) Avail: NTIS HC $3.00 CSCL 08H

Classical statistical tests were used to assess whether an apparent change in basin response is the result of nature's caprice or of man's deliberate action. Often the physical information about the variable tested was neglected. As a result the tests used are not optimal. Detection tests which use both the physical and statistical information can be designed and they will have a superior power to the standard tests. The test variable to be used is a linear combination of several physical and random variables with weight factors determined by a minimization procedure. The minimization is restricted by several equality constraints of a physical origin. When applied to the Colorado River Basin Pilot Project area the power of the test, expressed in years needed for detection, is increased by a factor of two.

Author (GRA)

N73-23514# Geophysical Survey Systems, Inc., North Billerica, Mass.

FEASIBILITY STUDY OF ELECTROMAGNETIC SUBSURFACE PROFILING

Rexford M. Morey and Walter S. Harrington, Jr. Oct. 1972 76 p refs
(Contract EPA-68-01-0062)
(PB-213892/0; EPA-R2-72-082) Avail: NTIS MF $0.95; SOD HC $1.25 as EPI.23/2:72-082 CSCL 13B

A study was made of a unique radar system which produces a continuous profile of subsurface conditions showing depth and location of geological formations and buried utilities. Information is obtained by sending electromagnetic pulses into the earth and then receiving the reflected pulses from interfaces and objects. The unit travels at 3 mph, and can detect interfaces directly below it to depths of 10 feet in clay and 25 feet in sand. Depth of penetration is governed by conductivity and dielectric constant. Water content influences these soil parameters; an increase in water content decreases penetration. The penetrability of the soil determines the maximum depth at which pipes can be detected. A break in the pipe can be detected by the saturated soil around the break. Author (GRA)

N73-23515# New Mexico Inst. of Mining and Technology, Socorro.

OZONE AND POINT DISCHARGE MEASUREMENTS UNDER THUNDERCLOUDS

A. Shlanta and C. B. Moore Mar. 1972 31 p refs
(Contract N00014-67-A-0267-0001; NR Proj. 082-233)
(AD-758130) Avail: NTIS CSCL 04/1

Short duration increases in the concentration of atmospheric ozone have been observed beneath active New Mexican thunderstorms in the vicinity of an exposed and grounded, sharp metal rod. These ozone transients follow immediately the emission of charge into the air from the metal point under the influence of atmospheric electricity. The increases are greater when associated with negative charge emission than with positive; the maximum ozone concentration above lightning-induced emission of negative charge has been about 6.4 times that of the fine weather concentration (about 6 ozone molecules per hundred million air molecules). Longer duration increases in the atmospheric ozone to about 1.5 times the prestorm concentration are found above a collection of natural grass points when overhead clouds are electrified with a net positive charge. Comparison of the ultraviolet radiation pulses from negative and positive point-to-plane discharges suggests a photochemical explanation for the relatively large production of ozone by negative charge emission. (Author Modified Abstract) GRA

N73-23516# Regis Coll., Weston, Mass.
ROCKET AND SATELLITE EXPERIMENTS FOR THE MEASUREMENT OF THE PROPERTIES OF THERMAL AND HIGH ENERGY PLASMA Final Report, 30 Jul. 1971 - 30 Sep. 1972
Mukhtar Ahmed and Lalitha D. V. Rao 2 Nov. 1972 70 p refs
(Contract F19628-12-C-0021)
(AD-755390; AFCRL-72-0662) Avail: NTIS CSCL 04/1

The work carried under this contract covers the routine reduction and analysis of data obtained from the Spherical Electrostatic experiments on board the OGO 1 and 3, INJUN 5 and ISIS-1 satellites. The data analysed were examined and theoretical interpretations were made thereby enabling an understanding of the physical processes operating in the magnetospheric region of space. Author (GRA)

14 INSTRUMENTATION AND PHOTOGRAPHY

Includes design, installation, and testing of instrumentation systems; gyroscopes; measuring instruments and gages; recorders; transducers; aerial photography; and telescopes and cameras.

N73-23517 British Broadcasting Corp., Kingswood (England). Research Dept.
THE REPRODUCTION OF NEGATIVE FILM BY TELECINE
F. A. Griffiths 1973 9 p refs
(BBC-RD-1973/2) Avail: BBC, Kingswood Warren, Tadworth, Surrey, England

The technique of reproducing negative color film in a telecine is discussed, and the essential features of the signal processing are described. The suitability of flying-spot and camera-tube telecines for this purpose is also compared, particularly with reference to the achievable signal-to-noise ratios. Author

N73-23518# National Bureau of Standards, Washington, D.C. Heat Div.
LOW TEMPERATURE THERMOMETRY Interim Report, 1 Jan. - 31 Dec. 1972
George Cataland and Harmon H. Plumb May 1973 23 p refs
(NBS-TN-765) Avail: SOD HC $0.40 Domestic Postpaid or $0.30 GPO Bookstore as C13.46:765

Earlier acoustical thermometer speed of sound isotherms are compared with recent measurements. Where systematic deviations had appeared in smoothing through acoustically derived temperatures via germanium thermometers, a possible solution has emerged; more precise temperature control of the acoustical thermometer is desirable and was realized. A cursory examination of the applicability of the Helmholtz-Kirchhoff equation was made with a modified sonic chamber. Measurements with the modified instrument show no changes in the experimental results. The maintenance of the NBS P2-20 (1965) scale is described. A new calibration apparatus was constructed to accommodate more germanium thermometers thus reducing the calibration cost per thermometer during a calibration run. Author

N73-23519# Australian Post Office Research Labs., Melbourne.
ELECTRICALLY SUPPRESSED ZERO VOLTMETER (205-255 VOLT RMS)
A. J. Stevens Dec. 1972 10 p refs
(Rept-6734) Avail: NTIS HC $3.00

An accurate voltmeter was designed using a class 1.0 accuracy meter movement and an electronic suppression circuit to provide an instrument reading from 205 to 255 volts rms. Tests on six models showed an accuracy of within plus or minus 0.3 percent between 5 C and 35 C. Author

N73-23520# Defence Research Establishment Valcartier (Quebec).
EVALUATION TECHNIQUES FOR INFRARED LINE SCAN SYSTEMS
G. A. Morley, D. Mckinnon, and R. Erickson Dec. 1972 24 p refs
(DREV Proj. 97-82-07)
(DREV-TN-2053/72) Avail: NTIS HC $3.25

The image-forming ability of an IRLS system has been assessed by means of laboratory measurements and in-flight testing using a ground test array. The laboratory tests have included determination of the over-all system modulation transfer function, amplitude characteristics and the minimum resolvable temperature. The ground test array consists of a 3-bar wedge pattern and a radiance step constructed of dissimilar panels of painted and sand-blasted aluminum. Analysis of the imagery resulting from over-flying the array yields data of the amplitude characteristics and the noise-limited resolution of the system. Author

N73-23521# Ruhr Univ., Bochum (West Germany). Abteilung fuer Elektrotechnik.
INDUCTION ARRANGEMENT IN ELECTRONIC SPIN RESONANCE SPECTROSCOPY Ph.D. Thesis [INDUKTIONSANORDNUNGEN IN DER ELEKTRONENSPINRESONANZSPEKTROSKOPIE]
Alexander Witte 1971 146 p refs In GERMAN
Avail: NTIS HC $9.50

Analogy to transmission resonators and their improvement by application of low noise microwave preamplifiers was used to study electron resonance inductive ordering. Microwave amplifier feedback coupling from resonator output to input produced spin concentrations at resonance field strength and stable eigenfrequency excitation of the resonant oscillator. Transl. by G.G.

N73-23522# Australian Post Office Research Labs., Melbourne.
THE CALCULATION OF THE RESONANCE FREQUENCY OF A CYLINDRICAL CAVITY FREQUENCY METER AT MICROMETER SCREW SETTINGS BETWEEN THE SET OF CALIBRATION POINTS
L. A. Denger Jan. 1970 16 p refs
(Rept-6659) Avail: NTIS HC $3.00

Resonance frequencies of a cylindrical cavity are calculated to determine the accuracy of a theoretical formula which is applied to the measurement of frequencies with such a cavity. Author

N73-23523# Tokyo Univ. (Japan). Inst. of Space and Aeronautical Science.
DEVELOPMENT OF X-RAY POLARIMETER BY DETECTING SECONDARY FLUORESCENT X-RAYS
Tadashi Kifune Dec. 1972 7 p refs
(ISAS-489) Avail: NTIS HC $3.00

A new kind of X-ray polarimeter, which was successfully operated below 2 KeV X-ray, is described. The angular distribution of secondary fluorescent X-rays emitted in the process of photoelectric effect is expected to exhibit an asymmetry correlated with the polarization vector of the initial X-ray. This asymmetrical behavior is utilized for polarization measurement. Author

N73-23524# Bonn Univ. (West Germany). Physikalisches Inst.
GERMANIUM BOLOMETER MEASUREMENTS IN THE INFRARED AT TEMPERATURES BETWEEN 1.57 K AND 4.2 K
D. Mueller and D. Offermann Bundesmin. fuer Forsch und Tech. Feb. 1973 41 p refs In GERMAN; ENGLISH summary Sponsored by Bundesmin. fuer Forsch. und Tech
(BMFT-FBW-73-05) Avail: NTIS HC $4.25, ZLDI Munich: 8,85 DM

Testing of two liquid-helium-cooled Germanium-bolometers in the far infrared region is described. Blackbody cavities at temperatures between 13 C and 80 C were used as infrared sources. The responsivity of the bolometers was measured at different chopper frequencies and at cryostat temperatures between 1.57 K and 4.2 K, which were obtained by varying the helium vapor pressure in the Dewar. An upper limit of the noise equivalent power NEP was determined for both of the bolometers. The measurements showed, that the responsivity of the bolometers at temperatures between 2.18 K and 4.2 K depended on the amount of liquid helium in the dewar and on the dewar construction. The implications of the results obtained

are discussed for the design of an aeronomic rocket payload containing an infrared detector itself. Author

N73-23525*# General Electric Co., Philadelphia, Pa.
AN INVERTER RATIO FAILURE DETECTOR Patent Application
Albert P. Wagner, Theodore J. Ebersole, and Robert E. Andrews, inventors (to NASA) Filed 10 May 1973 32 p Prepared for JPL
(Contracts NAS7-100; JPL-952536)
(NASA-Case-NPO-13160-1; US-Patent-Appl-SN-359157) Avail: NTIS HC $3.75 CSCL 14B

A failure detector for a dc to ac inverter based on the respective predetermined ratios of voltages and currents between the inputs and outputs, is reported. NASA

N73-23526*# McDonnell-Douglas Corp., Long Beach, Calif.
A DEVICE FOR USE IN LOADING TENSION MEMBERS Patent Application
Walter T. Appleberry, inventor (to NASA) Filed 10 May 1973 13 p Sponsored by NASA
(NASA-Case-MFS-21488-1; US-Patent-Appl-SN-359156) Avail: NTIS HC $3.00 CSCL 14B

A device for use in loading tension members with preselected stress is reported. The indicator is charaterized by an elongated elastic body having extended from the opposite ends threaded shanks adapted to be coupled with selected tension members, a pair of external shoulders, and a rigid tubular sleeve interposed between shoulders so that as tension is applied to the elastic body for imparting strain, the movable shoulder advances into abutting engagement with the sleeve, whereby the sleeve is placed in compression once the tensile forces are removed from the shanks. NASA

N73-23527*# National Aeronautics and Space Administration. John F. Kennedy Space Center, Cocoa Beach, Fla.
SIGNAL CONDITIONER TEST SET Patent Application
Walter H. Houck and Jon D. Stigberg, inventors (to NASA) Filed 30 Mar. 1973 16 p
(NASA-Case-KSC-10750-1; US-Patent-Appl-SN-346372) Avail: NTIS HC $3.00 CSCL 14B

A system is reported for testing components contained in a signal conditioning module having a transistor and capacitor included in a circuit. The system includes a housing with a socket into which the module to be tested is plugged. A test switch is provided for selectively connecting a variable load to either a transistor or capacitor in the circuit for testing the operation of such. A signal generating circuit is provided for generating signals for use in testing the components of the module. NASA

N73-23528*# National Aeronautics and Space Administration. Lewis Research Center, Cleveland, Ohio.
USE OF A TORSIONAL PENDULUM AS A HIGH-PRESSURE GAGE AND DETERMINATION OF VISCOSITY OF HELIUM GAS AT HIGH PRESSURES
James E. Maisel, Rayjor W. H. Webeler, and Hubert H. Grimes Washington May 1973 25 p refs
(NASA-TN-D-7241; E-7308) Avail: NTIS HC $3.00 CSCL 14B

Three torsional crystal parameters were examined for suitability in sensing pressure in gases up to 131 million newtons per square meter. The best parameters were found to be the change in crystal decrement at resonance and the change in crystal electrical resistance at resonance. The change in crystal resonant frequency did not appear to be a reliable pressure measuring parameter. Pure argon and pure helium gases were studied for use as working fluids. Helium functioned better over a wider pressure range. Calibration of the gage also provided a measure of the viscosity-density product of the gas as a function of pressure. These data, together with known extrapolated density data, permitted the determination of the viscosity of helium to 131 million N/square meter. Author

N73-23529# Joint Publications Research Service, Arlington, Va.
UNDERWATER SEARCH SYSTEMS, INSTRUMENTS AND DEVICES
R. F. Zhukov, Kondratovich, S. D. Mogilnyy, and B. I. Tsipko 3 May 1973 144 p refs Transl. into ENGLISH of the book "Sistemy, Pribory i Ustroystva Podvodnogo Poiska" Moscow, Voyenizdat, 1 Aug. 1972 182 p
(JPRS-58916) Avail: NTIS HC $9.25

The physical principles of constructing underwater search systems, their instruments and devices are studied. Descriptions of the systems, instruments, devices, physical principles, constructions, and operational methods are gathered from foreign publications. Examples are presented of the organization of underwater search operations -- the search for the sunken Affray, Thresher and Scorpion submarines, the American hydrogen bomb lost off the coast of Spain and other objects. Author

N73-23530*# Hawaii Univ., Honolulu. Inst. for Astronomy.
A HIGH-RESOLUTION FOURIER TRANSFORM SPECTROMETER FOR PLANETARY SPECTROSCOPY Final Report
Dale P. Cruikshank and W. M. Sinton 1 Feb. 1973 13 p
(Grant NGR-12-001-083)
(NASA-CR-131893) Avail: NTIS $3.00 CSCL 14B

The employment of a high-resolution Fourier Transform Spectrometer (FTS) is described for planetary and other astronomical spectroscopy in conjunction with the 88-inch telescope at Mauna Kea Observatory. The FTS system is designed for a broad range of uses, including double-beam laboratory spectroscopy, infrared gas chromatography, and nuclear magnetic resonance spectroscopy. The data system is well-suited to astronomical applications because of its great speed in acquiring and transforming data, and because of the enormous storage capability of the magnetic tape unit supplied with the system. The basic instrument is outlined 2nd some of the initial results from the first attempted use on the Mauna Kea 88-inch telescope are reported. Author

N73-23531*# Arizona Univ., Tucson. Space Astronomy Group.
LITERATURE SURVEY FOR SUPPRESSION OF SCATTERED LIGHT IN LARGE SPACE TELESCOPES
W. G. Tifft and B. B. Fannin 16 Feb. 1973 101 p refs
(Contract NAS8-27804)
(NASA-CR-124240) Avail: NTIS HC $7.25 CSCL 20F

A literature survey is presented of articles dealing with all aspects of predicting, measuring, and controlling unwanted scattered (stray) light. The survey is divided into four broad classifications: (1) existing baffle/telescope designs; (2) computer programs for the analysis/design of light suppression systems; (3) the mechanism, measurement, and control of light scattering; and (4) the advantages and problems introduced by the space environment for the operation of diffraction-limited optical systems. Author

N73-23532*# Ohio State Univ., Columbus. ElectroScience Lab.
RADAR/RADIOMETER FACILITIES FOR PRECIPITATION MEASUREMENTS
D. B. Hodge and R. C. Taylor Mar. 1973 25 p
(Grant NGR-36-008-080)
(NASA-CR-130235; TR-2374-13) Avail: NTIS HC $3.25 CSCL 14B

The OSU ElectroScience Laboratory Radar/Radiometer Facilities are described. This instrumentation includes a high-resolution radar/radiometer system, a fully automated low-resolution radar system, and a small surveillance radar system. The high-resolution radar/radiometer system operates at 3, 9, and 15 GHz using two 9.1 m and one 4.6 m parabolic antennas, respectively. The low-resolution and surveillance radars operate at 9 and 15 GHz, respectively. Both the high- and low-resolution systems are interfaced to real-time digital processing and recording systems. This capability was developed for the measurement of the temporal and spatial characteristics of precipitation in conjunction with millimeter wavelength propagation studies utilizing the Advanced Technology Satellites. Precipitation characteristics derived from these measurements could also be of direct benefit in such diverse areas as: the atmospheric sciences, meteorology, water resources, flood control and warning, severe storm warning, agricultural crop studies, and urban and regional planning. Author

N73-23533# Fraunhofer-Gesellschaft zur Forderung der Angewandten Forschung e. V., Grafschaft (West Germany). Inst. fuer Aerobiologie.

MEASUREMENT OF AEROSOL PARTICLE SIZE DISTRIBUTION WITH AN IMPROVED SPECTRAL IMPACTOR [ZUR MESSUNG DER GROESSENVERTEILUNG DES FEIN STAUBES MIT EINEM VERBESSERTEN SPEKTRALIMPAKTOR]

D. Hochrainer Bonn Bundeswehramt 1973 26 p refs In GERMAN; ENGLISH summary Sponsored by Bundesmin. der Verteidigung

(BMVg-FBWT-73-1) Avail: NTIS HC $3.50; Bundeswehramt, Bonn: 25 DM

An impactor which deposits aerosol particles of aerodynamic diameters between 0.5 and 5 microns according to their size in a single stage is described. Concentric flows of clean air and aerosol are joined, accelerated and aerodynamically focused in a round nozzle. The particles are deposited on a slide, the larger particles closer to the center. The calculated calibration from a flow field model is in qualitative agreement with the empirical calibration. Particle size measurements of aerosols in coal mines and their size distributions are reported. Author (ESRO)

N73-23534# Fraunhofer-Gesellschaft zur Forderung der Angewandten Forschung e. V., Grafschaft (West Germany). Inst. fuer Aerobiologie.

DOSAGE DEVICE FOR DILUTION OF CONCENTRATED AEROSOLS [EIN DOSIERGERAET ZUR VERDUENNUNG VON KONZENTRIERTEN AEROSOLEN]

F. J. Moenig and W. Stoeber Bonn Bundeswehramt 1973 19 p refs In GERMAN; ENGLISH summary

(BMVg-FBWT-73-2) Avail: NTIS HC $3.00; Bundeswehramt, Bonn: 25 DM

A dosage device designed for diluting concentrated aerosols at ratios between 1:60 and 1:800 is described. The device periodically feeds samples of small fixed volumes of the original aerosol into a continuous flow of clean air. The total flow of diluted aerosol does not exceed the range of several liters per minute. The periodic samples are taken and handled in such a way that the aerosol particles are subjected to minimal external forces. The apparatus shows minimal particle losses in a performance test. Author (ESRO)

N73-23535# Fraunhofer-Gesellschaft zur Forderung der Angewandten Forschung e. V., Grafschaft (West Germany).

INVESTIGATION OF AEROSOL PARTICLE DISTRIBUTION ACCORDING TO AERODYNAMIC DIAMETER AND MASS BY MEANS OF A SPIRAL CENTRIFUGE, COMPARED WITH OTHER AEROSOL SEPARATORS [UNTERSUCHUNG DER VERTEILUNG DER AERODYNAMICHEN GROESSE UND DER MASSE VON AEROSOLTEILCHEN MIT HILFE DER SPIRALZENTRIFUGE IM VERGLEICH MIT ANDEREN AEROSOLABSCHEIDERN]

W. Stoeber, H. Flachsbart, and C. Boose Bonn Bundeswehramt 1973 31 p refs In GERMAN; ENGLISH summary

(BMVg-FBWT-73-3) Avail: NTIS HC $3.75 Bundeswehramt, Bonn: 25 DM

The aerodynamic size and mass distribution of aerosol particles as determined with a spiral centrifuge is compared to results of other precipitators. The spiral centrifuge, a particle-size spectrometer for aerosols, facilitates the precipitation of aerosols in the size range of less than 0.80 micrometers up to 6 micrometers in diameter. The particles are separated according to their aerodynamic diameter along a strip foil of 180 cm length. The calibration of the deposit strip in terms of aerodynamic diameters permits the determination of the size distribution by a count analysis. The mass distribution can be obtained by gravimetric or, in case of a fluorescein test aerosol, by fluorometric analysis. Due to small irregularities of the deposition patterns, empirical corrections may apply to the experimental data. Author (ESRO)

N73-23536# Defense Documentation Center, Alexandria, Va.

COLOR PHOTOGRAPHY Bibliography Report, Mar. 1960 - Aug. 1972

Mar. 1973 171 p refs Revised

(AD-756700; DDC-TAS-73-10) Avail: NTIS CSCL 14/5

The bibliography contains unclassified and unlimited reports on Color Photography. References range from techniques for producing color pictures from black-and-white negatives to using aerial photography in different spectrum intervals to study vegetation and soils. References included Pseudocolor Enhancement of Biomedical Images; and Photoelectronic Color Separation by Servomechanisms in Cartography. Specialized Photosensitive materials for laser research are also discussed. Author (GRA)

N73-23537# Naval Research Lab., Washington, D.C.

A REVIEW OF MAGNETOMETERS AND RADIATION DETECTORS, ADDENDUM Final Report

Edward H. Takken 29 Jan. 1973 24 p refs

(NRL Proj. P05-04; RR0010242)

(AD-756175; NRL-7506-Add) Avail: NTIS CSCL 17/6

The report is a two-part addendum to NRL Report 7400, An Evaluation of Cryogenic and Competing Noncryogenic Devices for Naval Applications Such as MAD, Surveillance, Radiation Detection, and Communications (March 1972). The first part covers superconducting and optically pumped magnetometers and gives a short discussion of loops and solenoids. Superconducting radiation detectors and their many competitors are discussed in the second part. Author (GRA)

N73-23538# Office of Naval Research, London (England).

PHYSICS OF DISPLAY DEVICES MEETING AT IMPERIAL COLLEGE

Arthur H. Waynick 31 Jan. 1973 14 p Meeting held at London, 25 Oct. 1972

(AD-757649; ONRL-C-22-72) Avail: NTIS CSCL 09/5

A report is made on a colloquium concerned with gas discharge, liquid crystal and PLZT, ferroelectric ceramic, display devices. The present status of some industrial research activities in these areas, in Europe, is also involved. Author (GRA)

N73-23539# Ballistic Research Labs., Aberdeen Proving Ground, Md.

DESIGN OF AN INTERFEROMETRIC PHASE DETECTOR

John M. Evans Nov. 1972 22 p refs

(DA Proj. 1T0-61101-A-91A)

(AD-756885; BRL-MR-2247) Avail: NTIS CSCL 20/6

The design of a homodyne interferometer to measure the phase variations of a laser beam wave front is described. Energy from two sampling apertures is combined on photodetectors with the Doppler-shifted energy from a third aperture, and the phase relationship is determined. Author (GRA)

N73-23540# Technology, Inc., Dayton, Ohio.

EVALUATION OF THE NASA ELECTRONIC STRAIN LEVEL COUNTER AS A FATIGUE DAMAGE MONITOR Final Report, Apr. - Dec. 1972

Larry E. Clay and Sandra K. Buehler Wright-Patterson AFB, Ohio AFFDL Jan. 1973 51 p refs

(Contract F33615-72-C-1249; AF Proj. 1467)

(AD-757210; AFFDL-TR-72-135) Avail: NTIS CSCL 14/2

The NASA Electronic Strain-Level Counter was evaluated by analyzing the data recorded during 26 flights on an A-37B aircraft. The strain-level counter output was compared with data from a collocated strain gage recorded by a digital magnetic tape recorder. Fatigue damages were computed for several hypothetical strain-level counters to determine their suitability as fleet damage monitoring devices. (Author Modified Abstract) GRA

N73-23541# Aeronautical Systems Div., Wright-Patterson AFB, Ohio.

ANALYSIS OF DOPPLER VELOCITY SENSOR PERFORMANCE IN PRECIPITATION

David J. Krile Jan. 1973 81 p refs

(AD-757509; ASD-TR-72-78) Avail: NTIS CSCL 01/4

Airborne Doppler velocity sensors obtain measurements of aircraft groundspeed by observing Doppler frequency shifts in beams of microwave energy reflected from the earth. When hydrometeors exist between the aircraft and the earth, some of the received energy is a result of reflections from the hydrometeors. Computer simulations were performed to determine the amount of energy reflected from raindrops with pulsed, CW, and FM/CW Dopplers. Descriptions of the simulations and their results are presented herein. They indicate that significant amounts of energy are received from rain reflections even with moderate rain rates. (Author Modified Abstract) GRA

N73-23542# Oxford Univ. (England). Dept. of Engineering Science.
A DOUBLE-PULSE TORSIONAL HOPKINSON-BAR TECHNIQUE FOR INVESTIGATING STRAIN-RATE EFFECTS Interim Report, Mar. - Oct. 1972
John D. Campbell Wright-Patterson AFB, Ohio AFML Nov. 1972 25 p refs
(Grant AF-AFOSR-2056-71; AF Proj. 7353; AF Proj. 7351)
(AD-757527; OUEL-1036/72; AFML-TR-72-207) Avail: NTIS CSCL 14/2

A brief description is given of an apparatus by means of which a torsional wave can be generated which exhibits a double-step structure. Each step has a rise time of order 40 microseconds, and the time between them is about 150 microseconds; three different bar systems have been built, giving respectively 4.6, 6.5 and 10.0 as the nominal ratio of the amplitude of the second step to that of the first. By means of this apparatus, a short thin-walled tubular specimen can be subjected to a sudden change in strain rate at rates in the range 10 to 500 s to the minus 1 power. The test method is described, and some preliminary results are presented and discussed in order to illustrate the potential and limitations of the technique. Author (GRA)

N73-23543# Sanders Associates, Inc., Nashua, N.H.
TACTILE DISPLAY FOR AIRCRAFT CONTROL Semiannual Technical Report
Don H. Ross, Richard A. Sanneman, William H. Levison, Robert B. Tanner, and Thomas J. Triggs Jan. 1973 111 p refs Prepared in cooperation with Bolt, Beranek, and Newman, Inc., Cambridge, Mass.
(Contract N00014-73-C-0031; ARPA Order 2108; NR Proj. 196-123)
(AD-757344) Avail: NTIS CSCL 01/4

In current aircraft, nearly all the flight parameter information available to the pilot is transmitted to him visually, whether under visual contact or instrument flying conditions. It has long been recognized that during instrument flying conditions the task of scanning just the essential instruments is a taxing, fatiguing one. It may be that displays using information from other modalities can alleviate the demands of this task. Tactual presentations possess considerable promise of being suitable substitutes for visual displays in flight-control applications. The goal of this program is to develop tactual displays that can be utilized for flight control. (Author Modified Abstract) GRA

N73-23544# Naval Electronics Lab. Center, San Diego, Calif.
A HIGH SPEED DIGITAL RECORDING SYSTEM FOR VLF AND ELF SFERIC WAVEFORMS Interim Report
Robert J. Gallenberger 10 Nov. 1972 40 p refs
(NELC Proj. M208)
(AD-757427; NELC-IR-208-1) Avail: NTIS CSCL 04/1

The report describes a system for digitally recording atmospheric noise (sferics). The system records on magnetic tape the received sferic waveforms, sferic direction of arrival and time of arrival. Recording rates of several thousand per minute are possible. Three systems have been constructed and simultaneously operated at widely separated locations. Preliminary results from the three station test are discussed. Author (GRA)

N73-23545# Michigan Univ., Ann Arbor. Dept. of Engineering Mechanics.
LASER-DOPPLER ANEMOMETER MEASUREMENTS OF TURBULENCE IN DRAG REDUCING FLOW
Goron L. Guenterberg Dec. 1972 102 p refs
(Contract N00014-67-A-0181-0030; ORA Proj. 065050)
(AD-757075) Avail: NTIS CSCL 20/4

The drag reduction, mean flow, and turbulence properties of several concentrations of Separan AP30 and water in a fully developed turbulent pipe flow were studied using a two-component laser-Doppler anemometer. This measurement technique was chosen because of its inherent advantages over the traditional measuring techniques that have been used in previous studies of drag reducing flows. A polymer injection technique was used. A slurry of methanol and polymer powder was injected directly into the flowing water, providing a fresh, unaged polymer solution. (Author Modified Abstract) GRA

N73-23546# Cornell Aeronautical Lab., Inc., Buffalo, N.Y.
INERTIA MEASURING EQUIPMENT DESIGN STUDY
C. H. Hutchinson 1973 166 p
(Contract AF 33(600)-31919; AF Proj. 8219)
(AD-758398; CAL-IM-1060-F-2) Avail: NTIS CSCL 14/2

A practical method of measuring all moments and products of inertia of aircraft weighing up to 300,000 pounds was devised. Designs and specifications for the required equipment and instrumentation are presented. The measurement technique employs forced oscillation of a large platform upon which the aircraft is rigidly mounted. Forces and moments acting on the aircraft are resolved and summed in an orthogonal coordinate system during oscillation about each of three fixed axes. These data and the time-history of the motion are used to compute the moments and products of inertia. (Author Modified Abstract) GRA

N73-23547# Panametrics, Inc., Waltham, Mass.
ULTRASONIC MASS FLOWMETER FOR ARMY AIRCRAFT ENGINE DIAGNOSTICS Final Technical Report, Jun. 1971 - Aug. 1972
Lawrence C. Lynnworth, Norman E. Pedersen, and Edmund H. Carnevale Fort Eustis, Va. Army Air Mobility Res. and Develop. Lab. Jan. 1973 116 p refs
(Contract DAAJ02-71-C-0061; DA Proj. 1F1-62203-A-434)
(AD-758462; USAAMRDL-TR-72-66) Avail: NTIS CSCL 14/2

Development is reported on a new type of ultrasonic mass flowmeter for fuel flow in gas turbine engines, consisting of a flow velocimeter, a densitometer, a time intervalometer, and a metering section containing nonintrusive transducers. The complete system was tested on various liquids at rates up to 5000 lb/hr. It was operated during and recalibrated after 104 hours exposure to a contaminated fluid flowing at approx. 1900 lb/hr. Response time was determined. The flowmeter can operate in laminar, transitional, and turbulent flow, using a special method of weighing the profile. (Author Modified Abstract) GRA

N73-23548# Bureau of Radiological Health, Rockville, Md. Div. of Electronic Products.
CALORIMETRIC CALIBRATION METHOD FOR A COMMERCIAL POWER MONITOR FOR USE WITH HIGH POWER MICROWAVE GENERATORS
William A. Herman, Donald W. Peak, David L. Conover, and Lenton W. Strong Sep. 1972 36 p refs
(PB-213970/7; BRH/DEP-73-1; DHEW(FDA)-73-8010) Avail: NTIS HC $3.00 CSCL 14B

A power monitor used with a high-power (2.5-kW) microwave generator operable in the 2450-MHz ISM band was calibrated by a calorimetric method. Several measurements of the forward and reflected power were made at two positions one-quarter of a guide wavelength apart on the waveguide assembly connecting the generator and the load. The normalized average of the two determinations of the forward and reflected power yielded calibration factor values that were independent of the VSWR of the load and the directivity of the coupler which monitored the forward and reflected power. A linear equation was empirically derived to specify the power delivered to the load as a function of the forward and reflected power meter indications.
Author (GRA)

N73-23549# Naval Postgraduate School, Monterey, Calif.
INVESTIGATION OF A QUASI-HOLOGRAPHIC SYNTHETIC-APERTURE ACOUSTICAL IMAGING SYSTEM M.S. Thesis
Robert George Driscoll Dec. 1972 44 p refs
(AD-757253) Avail: NTIS CSCL 17/1

A side-looking sonar system which uses coherent electrical processing is investigated. Such a system produces a quasi-hologram of the reflected sound field which may be subsequently imaged to give a visual presentation of the insonified region. An actual working laboratory system is constructed and several quasi-holograms are depicted in the Data and Results section. Imaging is not completed, however, an optical processing arrangement to accomplish this task is presented. Author (GRA)

N73-23036 Joint Publications Research Service, Arlington, Va.
DYNAMIC KATATHERMOMETER FOR MEASURING THE

COOLING EFFECT OF THE ENVIRONMENT
L. Novak and Y. Cesnak *In its* Space Biol. and Med., No. 2, 1973 15 May 1973 p 85-90 refs (For availability see N73-23024 14-04)

N73-23902 Air Force Systems Command, Wright-Patterson AFB, Ohio. Airborne Computer Engineering Branch.
AVIONIC SYSTEMS INTEGRATION USING DIGITAL COMPUTERS
Erwin C. Gangl *In* AGARD Automation in Manned Aerospace Systems Mar. 1973 5 p (For availability see N73-23881 14-31)

N73-23975* Jet Propulsion Lab., Calif. Inst. of Tech., Pasadena.
GENERATION OF NARROW HIGH CURRENT PULSES
V. J. Menichelli and L. A. Rosenthal *In its* Quart. Tech. Rev., Vol. 2, No. 4 Jan. 1973 p 38-43 (For availability see N73-23970 14-34)
CSCL 14B

15 MACHINE ELEMENTS AND PROCESSES

Includes bearings, seals, pumps, and other mechanical equipment; lubrication, friction, and wear; manufacturing processes and quality control; reliability; drafting; and materials fabrication, handling, and inspection.

N73-23550# Laboratorio de Acustica e Sonica, Sao Paulo (Brazil).
ULTRASONIC INSPECTION AND CONTROL OF LAMINATED STEEL BLOCKS PRIOR TO MACHINING
L. X. Nepomuceno 8 Dec. 1972 7 p In PORTUGUESE; ENGLISH summary
(TR-7212.620) Avail: NTIS HC $3.00

The inspected blocks, equipment and accessories are described along with the adopted procedures, specifications and results. The results are shown in schematics indicating the defect positions. Photos of the observed echograms are included.
Author

N73-23551*# Bendix Corp., Ann Arbor, Mich. Aerospace Systems Div.
A STUDY OF THE FEASIBILITY OF MECHANICAL PUMPS FOR USE WITH THE PIONEER-VENUS PROBE MASS SPECTROMETER INLET SYSTEM Final Report, 7 Feb. - 7 Apr. 1973
N. C. Thomas, W. E. Crosmer, and D. Nowak Apr. 1973 104 p refs
(Contract NAS2-7384)
(NASA-CR-114581; BSR-4036) Avail: NTIS HC $7.25 CSCL 13K

A survey of mechanical vacuum pumps was completed. A small Roots blower for flight mass spectrometer applications was evaluated with respect to system operating parameters in a number of different modes of operation. The survey indicated that a metal bellows pump might be a viable alternative for the systems requirements. The results of the study are given, including current status of possible flight-type pumps, a systems analysis using available pumps, and recommendations for fabrication and tests of a potential flight-type pump. D.L.G.

N73-23552*# National Aeronautics and Space Administration. Marshall Space Flight Center, Huntsville, Ala.
SPRAG SOLENOID BRAKE Patent Application
Dan H. Dane, inventor (to NASA) Filed 14 May 1973 16 p
(NASA-Case-MFS-21846-1; US-Patent-Appl-SN-359958) Avail: NTIS HC $3.00 CSCL 13I

An electrically operated brake is described, including a housing with a cylindrical chamber. A rotary member is carried within the cylindrical chamber for rotation about a longitudinal axis of the cylindrical chamber. Circumferentially spaced sockets are disposed in the outer surface of the rotary member for accommodating one end of sprags. Spring means urge the sprags in contact with an inner surface of the housing for locking said rotary member relative to said housing. A control member is adapted to be shifted longitudinally by an electrically operated means for forcing the sprags out of engagement with the housing. A spring forces the control member to return to its braking position when the electrically operated means is de-energized.
NASA

N73-23553*# Boeing Co., Cocoa Beach, Fla.
VARIABLE RESISTANCE CONSTANT TENSION AND LUBRICATION DEVICE Patent Application
Henry J. Smith, inventor (to NASA) Filed 4 Apr. 1973 20 p
(Contract NAS10-7200)
(NASA-Case-KSC-10723-1; US-Patent-Appl-SN-347952) Avail: NTIS HC $3.00 CSCL 13I

A variable resistance device which includes a cylindrical housing having elongated resistance wires is described. A movable arm having a supporting block on the outer end is rotatably carried by the cylindrical housing. An arcuate steel spring member is supported by the movable arm. A leather wiper member is carried adjacent to one end of the spring steel member, and an electrically conductive surface is carried adjacent to the other end. The supporting block maintains the spring steel member in compression, so that a constant pressure is applied to the conductive end of the spring steel member and the leather wiper. The leather wiper is saturated with a lubricating oil for maintaining a clean resistance wire as the movable arm is manipulated.
NASA

N73-23554*# Martin Marietta Corp., Denver, Colo.
INVESTIGATION OF CRYOGENIC RUPTURE DISC DESIGN Final Report, Jul. 1970 - May 1972
James B. Keough and Alan H. Oldland Apr. 1973 173 p refs
(Contract NAS3-14345)
(NASA-CR-121118) Avail: NTIS HC $10.75 CSCL 13K

Rupture disc designs of both the active (command actuated) and passive (pressure ruptured) types were evaluated for performance characteristics at cryogenic temperatures and for capability to operate in a variety of cryogens, including gaseous and liquid fluorine. The test results, coupled with information from literature and industry searches, were used to establish a statement of design criteria and recommended practices for application of rupture discs to cryogenic rocket propellant feed and vent systems.
Author

N73-23555*# National Aeronautics and Space Administration. Lewis Research Center, Cleveland, Ohio.
OXYGEN AND SULFUR INTERACTIONS WITH A CLEAN IRON SURFACE AND THE EFFECT OF RUBBING CONTACT ON THESE INTERACTIONS
Donald H. Buckley Washington May 1973 15 p refs
(NASA-TN-D-7283; E-7343) Avail: NTIS HC $3.00 CSCL 07D

The interaction of sulfur and oxygen with an iron surface was studied with Auger spectroscopy analysis both statically and during sliding-friction experiments in a vacuum environment. Oxygen, hydrogen sulfide, methyl mercaptan, and sulfur dioxide were adsorbed to an iron surface. Results indicate that sulfide films formed on clean iron surfaces are completely displaced by oxygen. Hydrocarbons containing sulfur, such as methyl mercaptan, adsorb dissociatively. Less sulfur is adsorbed during sliding with hydrogen sulfide and methyl mercaptan than in the absence of sliding. With both oxygen and sulfur dioxide, sliding did not affect the amount of material adsorbed to iron.
Author

N73-23556# Battelle Columbus Labs., Ohio.
THIN FILM RHEOLOGY OF BOUNDARY LUBRICATING SURFACE FILMS, PART 3 Final Report, 1 Jan. - 5 Dec. 1972
E. Drauglis, C. M. Allen, J. W. Droege, D. Ensminger, and R. J. Jakobsen Dec. 1972 45 p refs
(Contract N00019-72-C-0204)
(AD-757061) Avail: NTIS CSCL 11/8

The principal objective of the program is to obtain a more fundamental understanding of the chemistry and physics of thin films of liquids in contact with solid substrates and the application of this understanding to the development of more systematic methods for the solution of boundary lubrication problems encountered in modern aeropropulsion technology. The report

discusses the experimental techniques for the study of order in such films. Frustrated multiple internal reflection infrared spectroscopy (FMIR) and high resolution fourier transform nuclear magnetic resonance (NMR) were applied. In the first of these techniques, the film to be studied is formed on the surface of a prism, infrared radiation is sent into the prism, is multiply reflected and a spectrum is obtained that is characteristic of the liquid near the surface of the prism. Experiments performed on hexadecane films formed on germanium prism at various polarizations of the incident radiation showed conclusively that order must be present in hexadecane films. In addition, NMR experiments were performed on 1-octadecane films. In addition to the experimental work, an improved theory of the role of van der Waals forces in monolayer lubrication was developed. (Author Modified Abstract) GRA

N73-23557# Westinghouse Research Labs., Pittsburgh, Pa.
SOLID LUBRICATED BEARING TECHNOLOGY. PART 2: SOLID LUBRICATED HIGH SPEED BALL BEARINGS Final Report, 1 Jul. 1971 - 1 Nov. 1972
D. J. Boes Dec. 1972 44 p refs
(Contract F33615-70-C-1736; AF Proj. 3048)
(AD-756487; AFAPL-TR-71-69-Pt-2) Avail: NTIS CSCL 13/9

The report describes the second year effort of a two year program that had as its objective the development of improved, self-contained, solid lubricated ball bearings capable of at least 25 hours operation at speeds approaching 60,000 rpm. The program encompassed a temperature range of -40 F to 600 F and a maximum load combination of 75 lb thrust/25 lb radial. A high speed test stand was assembled that is capable of functionally evaluating the performance of solid lubricated ball bearings over a 60,000 rpm speed range. (Author Modified Abstract) GRA

N73-23558# Army Edgewood Arsenal, Md. Design Div.
APPLICATIONS IN COMPUTER AIDED DESIGN AND NUMERICAL CONTROL MANUFACTURING USING AUTOMATED DRAFTING AND DIGITIZING
Vernon R. Pearl Jan. 1973 86 p
(AD-755502; EA-TR-4720) Avail: NTIS CSCL 13/8

The construction and performance details for 4 cell sealed nickel-zinc batteries are presented. The batteries evaluated contained non-sintered positive nickel-hydroxide electrodes, Teflonated zinc oxide negative, Ag/Hg oxygen recombination electrodes and inorganic separators containing a Teflon binder. Initially the capacities of the batteries were about 8.2Ah and yielded an energy density of almost 30Wh/lb. The swelling problems of the nickel hydroxide electrode were investigated. GRA

N73-23559# Aeroprojects, Inc., West Chester, Pa.
ULTRASONIC BEAM LEAD BONDING EQUIPMENT Final Technical Report, 10 May 1971 - 30 Sep. 1972
Janet Devine Feb. 1973 30 p refs
(Contract F30602-71-C-0150)
(AD-757561; RR-72-35; RADC-TR-73-27) Avail: NTIS CSCL 13/8

Initial effort established the feasibility and practicability of an ultrasonic torsional welding system for simultaneously bonding the beam leads of a hybrid integrated circuit device to a suitable substrate. The design, fabrication, and evaluation of a laboratory welder for this application delineated requirements for an experimental ultrasonic beam lead bonder for field evaluation. The experimental unit consisted of a 60-kHz ultrasonic torsional welding system installed in a modified commercial micropositioner which provided x-y positioning of the beam leaded chip and incorporated an optical system with indexing for visual alignment of the chip. The welder accepts electrical power input up to about 50 watts and weld time up to 1.2 seconds; experimental data indicate this capability to be adequate for bonding commercially available beam lead devices. The process represents a practical alternative to current beam lead bonding techniques. Author (GRA)

N73-23560# Polytechnic Inst. of Brooklyn, N.Y. Dept. of Electrical Engineering and Electrophysics.
TIME-DEPENDENT STRESS-STRENGTH MODELS FOR NON-ELECTRICAL AND ELECTRICAL SYSTEMS
Leonard Shaw, Martin Shooman, and Robert Schatz 15 Mar. 1973 37 p refs
(Contract N00014-67-A-0438-0013; NR Proj. 042-307)
(AD-758396; EER-101) Avail: NTIS CSCL 14/4

Structural modeling of systems and failure rate modeling of components has proved quite successful in the reliability analysis of electrical systems. In the case of mechanical, pneumatic, hydraulic, etc. systems such techniques are hard to apply because of the distributed nature of the devices. In such cases stress-strength models are often used. These models are good for single stress situations, but must be modified to describe the commonly occurring situation of repeated stresses. A general reliability modeling technique is developed for time and/or cyclic dependence of the stress and strength distributions used to characterize failure modes in the stress-strength interference method. These distributions may change due to aging and cumulative damage, or due to the information gained by a history of non-failure. (Author Modified Abstract) GRA

N73-23561# Lord Mfg. Co., Erie, Pa.
ENVIRONMENTAL ENDURANCE TESTING OF AN ELASTOMERIC PITCH CHANGE BEARING Final Report
David L. Myers Fort Eustis, Va. Army Air Mobility Res. and Develop. Lab. Feb. 1973 115 p ref
(Contract DAAJ02-71-C-0044; DA Proj. 1F1-63204-DB-38)
(AD-758463; PE-158; USAAMRDL-TR-72-73) Avail: NTIS CSCL 13/9

Presented in the report are the results of pre-endurance and environmental endurance testing of the LM-726-1 elastomeric pitch change bearing designed for the all-elastomeric rotor in the AH-1G helicopter. Testing was conducted to form a basis for determining the airworthiness of the bearing in terms of expected reliability and inspection and replacement criteria. (Author Modified Abstract) GRA

N73-23562# Naval Air Development Center, Warminster, Pa. Air Vehicle Technology Dept.
DEVELOPMENT OF A SILICONE BASE NONFLAMMABLE HYDRAULIC FLUID FOR USE IN CURRENT AND FUTURE MILITARY AIRCRAFT Progress Report
Alfeo A. Conte, Jr. 7 Mar. 1973 47 p refs
(AD-758361; NADC-73055-30) Avail: NTIS CSCL 11/8

A nonflammable hydraulic fluid has been developed based on a chlorinated phenyl methyl silicone fluid. Laboratory results as well as limited hydraulic pump-loop circuit evaluations have demonstrated the unique antiwear properties of this silicone based fluid. In addition, compatibility of the fluid with Buna N elastomer seals has also been established. These results indicate the potential for use of this fluid as a replacement for MIL-H-5606 in current and future military aircraft. Author (GRA)

N73-23563# Army Coating and Chemical Lab., Aberdeen Proving Ground, Md.
DETERMINATION OF ZINC DIALKYL DIARYL DITHIOPHOSPHATE IN LUBRICATING OIL Final Report
Marjan Kolobielski Feb. 1973 44 p refs
(DA Proj. 1T0-62105-A-109)
(AD-757605; CCL-320) Avail: NTIS CSCL 11/8

The overall objective of the project is the development of new and improved methods for determining composition of lubricating oils used in internal-combustion engines. This particular study is concerned with the development of analytical methods for identifying, separating, and determining the concentration of zinc dialkyl(diaryl) dithiophosphate additive present in fully formulated lubricating oils. Simple, rapid, qualitative tests for identification of the additive were developed. The additive was separated from the base hydrocarbon oil and isolated in a concentrated form by means of elution chromatography on silica gel-celite mixtures. The best results were obtained when the water content of the silica amounted to about 15-20 percent. The approximate concentration of the additive was determined by a combination of methods consisting of hydrolysis, elution and gas chromatography, as well as elemental analysis. Author (GRA)

N73-23564# Army Missile Command, Redstone Arsenal, Ala. Systems Engineering Directorate.
RELIABILITY ANALYSIS OF UNPACED VISUAL INSPEC-

TION TASKS
Robert G. Wilson 15 Mar. 1973 96 p refs
(AD-757608; RC-73-1) Avail: NTIS CSCL 14/4

The research was directed toward application of classical hardware reliability analysis methods to describe human performance error rates on discrete tasks. The specific problem investigated was the mathematical formulation needed to describe the probability of human error associated with discrete unpaced, visual inspection tasks. Knowledge of the inspector's perception of the percentage defective, his ability to numerically express his perception, and the effect of a dynamic environment on each were several secondary objectives which impacted this research and which needed to be investigated. Ten subjects were laboratory tested, with the number of items to first error, items between errors, defects to first error, and defects between errors recorded. Through classical inference theory, the underlying distributions of errors were investigated. (Author Modified Abstract) GRA

16 MASERS

Includes applications of masers and lasers. For basic research see: 26 Physics, Solid-State.

N73-23565# Physics Lab. RVO-TNO, The Hague (Netherlands).
LITERATURE REVIEW OF ERBIUM LASERS
C. W. Lamberts Mar. 1973 14 p refs In DUTCH; ENGLISH summary
(PhL-1973-12) Avail: NTIS HC $3.00

The performance of erbium lasers with 1.5 micron wavelength is reported. The characteristics of various laser materials are tabulated to show the chemical composition, mode of operation, frequency, wavelength, and strength of output. The test equipment used in conducting the investigation is described.
Transl. by P.N.F.

N73-23566# Physics Lab. RVO-TNO, The Hague (Netherlands).
DYE LASERS
A. Huyser Feb. 1973 40 p refs In DUTCH; ENGLISH summary
(PhL-1973-2) Avail: NTIS HC $4.00

A treatise is given on the general characteristics and features of dye lasers. It is reported that flashlight and laser pumped dye lasers have been built which are tuneable over wide ranges. Special attention is paid to the lasing mechanism of dyes.
Author

N73-23567# Physics Lab. RVO-TNO, The Hague (Netherlands).
MEASUREMENTS ON PULSED YAG-Nd LASERS
J. Vriend Jun. 1972 62 p refs In DUTCH; ENGLISH summary
(PhL-1972-22) Avail: NTIS HC $5.25

Measurements performed on three different set ups of YAG-lasers are described. Two different Nd-YAG rods were available: one with the two end-faces perpendicular to the rod axis and the other cut and polished under the Brewster-angle. An Isomet KDP crystal and polarizer both with end faces perpendicular to the resonator axis were tested and compared with a brewster angle-polarizer and a KDP crystal that was furnished with glass rods. The electro-optic shutter with the components all cut at the Brewster-angle appeared to the superior to the Isomet shutter. And the Nd-YAG-rod with perpendicular end-faces is superior to the other. Combination of the best rod and shutter gave peak powers of up to 5 to 5 1/2 MW in pulse lengths of 16 nanoseconds. Author

N73-23568# Physics Lab. RVO-TNO, The Hague (Netherlands).
NOISE MEASUREMENTS AND THE DYNAMIC BEHAVIOR OF AVALANCHE AND OTHER PHOTODETECTORS
C. A. VantHof and T. Bakker Aug. 1972 24 p refs
(PhL-1972-24) Avail: NTIS HC $3.25

The overall-noise in a photodetection system, consisting of a germanium avalanche-photodiode and a low-noise amplifier is determined. The main contributions to the overall-noise are from the bulk- and guardring leakage currents and from the amplifier. The main parameter of interest for laser rangefinder applications is the noise-equivalent signal current, being equal to the peak value of the equivalent noise current at the amplifier input, divided by the avalanche multiplication factor. The optimum bias conditions for low-noise operation are temperature dependent. It is argued that current control is preferable to voltage control in order to stabilize against temperature variations. The optimum bias conditions and the corresponding minimum noise-equivalent signal currents are measured as functions of the ambient temperature. Author

N73-23569# Rockwell International Corp., Anaheim, Calif. Electronics Research Div.
TUNABLE 10 MICRON LASER, AN INTEGRATED OPTICS APPROACH TO INFRARED GAS LASERS Interim Technical Report, 1 Jun. - 31 Dec. 1972
D. B. Anderson and R. Shubert 26 Feb. 1973 72 p refs
(Contract N00014-72-C-0505; ARPA Order 1806)
(AD-757088; C72-650.10/501) Avail: NTIS CSCL 20/5

Current progress toward the development of a tunable CO2 laser using an integrated optics approach is described. Design parameters for application as a local oscillator in an optical heterodyne receiver are emphasized with tunability to accommodate the large Doppler offset. The integrated optics approach employs a nonuniform distributed iterative passive waveguide in close proximity to a planar active gas waveguide to form the resonant circuit. Backward wave Bragg diffraction coupling is employed between the active gas waveguide and the passive feedback waveguide. Transverse gas flow and transverse excitation are considered. The characteristics of nonuniform distributed feedback laser ring resonant circuits are analyzed employing a coupled mode approach. A 0.6 mm diameter bore capillary waveguide laser has been demonstrated. (Author Modified Abstract) GRA

N73-23570# Hughes Research Labs., Malibu, Calif.
PLASMA CATHODE FOR E-BEAM LASERS Semiannual Technical Report, 1 May - 30 Nov. 1972
R. C. Knechtli and G. N. Mercer 30 Nov. 1972 71 p refs
(Contract N00014-72-C-0496; ARPA Order 1807)
(AD-757086) Avail: NTIS CSCL 20/5

The technical goal of this program is to develop a superior substitute for the thermionic-cathode electron gun used for plasma conditioning in high energy lasers. Specifically, the program is directed toward developing a hollow cathode plasma electron source to replace the thermionic source commonly used in these electron guns. To fulfill the technical goals of the program, a theoretical and experimental development program is being carried out. A small scale prototype of the plasma cathode electron gun has been constructed and tested with excellent results. A high-voltage, full-size module is now under construction. (Author Modified Abstract) GRA

N73-23571# Polytechnic Inst. of Brooklyn, Farmingdale, N.Y.
BLEACHABLE ABSORBER LASER AMPLIFIER AND DETECTOR (BALAD) Final Report, 18 Nov. 1970 - 17 Nov. 1971
Gordon Gould and James T. Latourrette 23 Oct. 1972 76 p refs
(Contract F30602-71-C-0024; ARPA Order 1279)
(AD-757361; PIBEP-72-107; RADC-TR-72-313) Avail: NTIS CSCL 17/5

A detailed feasibility and design study has been made on the wide-angle, low noise BALAD receiver (Bleachable Absorber Laser Amplifier and Detector). Expressions have been derived for the achievable field-of-view, maximum gain and other specifications in terms of the dimensions and the measurable properties of the laser and absorber gases. Virtually error free detection is assured for signal pulses equal to 100 photons. A figure-of-merit has been measured for several absorber gases screened from the literature. BALAD receivers with 4000 resolution element field-of-view are feasible using SF6 and a CO2 amplifier at 10.6 micrometers and Xe with Xe at 3.5 micrometers. The use of the latter is recommended for the experimental test of the BALAD receiver. Three compact absorber configurations have been considered and will be further investigated. Application is to optical radar and to optical communications where signal direction is uncertain. Author (GRA)

N73-23572# Naval Postgraduate School, Monterey, Calif.
THE CONSTRUCTION OF A Nd:YAG LASER TO STUDY

ATMOSPHERIC TRANSMISSION PROPERTIES M.S. Thesis
Patrick Ralph OHarrow Dec. 1972 38 p refs
(AD-757249) Avail: NTIS CSCL 20/5

A neodymium laser was constructed to be used in a study of atmospheric transmission properties of 1.06 micrometer radiation. A Nd:YAG crystal was selected for use in the laser, and the physical and chemical properties of Nd:YAG as compiled from the literature are presented. A detailed description of the laser system design is given with the expected operational characteristics. The laser was operationally tested a number of times during which several of the design parameters were varied, but lasing action was never observed. An outline of the probable causes for failure is given in the concluding remarks.
Author (GRA)

N73-23573# Wayne State Univ., Detroit, Mich. Research Inst. for Engineering Sciences.
MODELING OF A PULSED CO/N2 MOLECULAR LASER SYSTEM. PART 2: EFFECT OF MIXTURE COMPONENTS AND TEMPERATURE VARIATION
Edward R. Fisher Nov. 1972 28 p refs Sponsored in part by ARPA
(Grant DA-ARO(D)-31-124-72-G103)
(AD-755197; RIES-72-48-Pt-2) Avail: NTIS CSCL 07/4

The CO molecular laser model described in a previous publication has been used to investigate the effect of molecular mixture components and kinetic temperature variations on improving the gain of low lying CO infrared transitions. Gas mixtures involving diatomic molecules with both larger and smaller vibrational level spacing than CO were investigated. Vibrational pumping of CO by a molecule having smaller vibrational spacing leads to negligible laser gain predictions due to the nonspecific nature of vibrational exchange processes. The largest predicted gain in the low lying transitions of CO was found for N2/CO mixtures at 77K in which appreciable gain in the 2-1 transition was found. Author (GRA)

N73-23574# Radio Corp. of America, Princeton, N.J.
EFFECTS OF TURBULENCE INSTABILITIES ON LASER PROPAGATION Quarterly Technical Report, 19 Sep. - 15 Dec. 1972
David A. DeWolf Jan. 1973 26 p refs
(Contract F30602-72-C-0486; ARPA Order 1279)
(AD-757221; PRRL-73-TR-1; RADC-TR-73-33; QTR-2) Avail: NTIS CSCL 20/6

The author reports results on Furutsu's contested theory of beam wave irradiance in turbulent air, on his attendance of the 17th General Assembly of URSI (Warsaw, Poland), on a simple model for studying feature resolution, on the log-amplitude variance for plane and spherical waves, and on the angle-of-arrival power spectrum for an interferometer. Section 2 deals exhaustively with the spherical-wave extension of the irradiance scintillation theory. (Author Modified Abstract) GRA

N73-23575# Whittaker Corp., Waltham, Mass. Space Sciences Div.
THE STUDY OF IMPROVED ELECTRODES FOR ION LASERS AND FOR MOLECULAR GAS LASERS Final Report, 1 Apr. 1971 - 31 Mar. 1972
Sol Aisenberg and Kuo Wei Chang Nov. 1972 63 p refs
(Contract N00014-71-C-0337)
(AD-757099; SSD-P-677-FR) Avail: NTIS CSCL 20/5

The program involves the study of improved electrode structures to lead to high efficiency ion lasers and high power high efficiency CO2 lasers. Various designs were explored but actual improved lasers were not completed in this short study program. An improved ion laser system is suggested which uses the more favorable hollow cathode electron beam discharge to produce CW and pulsed laser oscillations in both visible and UV ranges. A novel dual-plasma approach for high pressure, high power laser operation is also devised for the development of efficient, compact and powerful CO2 lasers. (Author Modified Abstract) GRA

N73-23576# Air Force Cambridge Research Labs., L. G. Hanscom Field, Mass.
OPTICAL PERFORMANCE EVALUATION OF INFRARED TRANSMITTING MATERIALS (LQ-10 HIGH POWER LASER WINDOW PROGRAM)
Bernard Bendow and Peter D. Gianino 19 Sep. 1972 29 p refs Presented at AIME Conf. on Electron. Mater., Boston, 28-30 Aug. 1972
(AF Proj. 5621)
(AD-756825; AFCRL-72-0565; AFCRL-PSRP-512) Avail: NTIS CSCL 20/5

A nonuniform laser beam traversing a material sample undergoes thermal lensing, that is, distortion and defocusing due to thermally induced changes in refractive index and bulging of sample faces. Vector Kirchhoff diffraction theory is applied to provide a detailed picture of the transmitted beam properties in the presence of lensing. In particular, the time evolution of the focal properties and the intensity degradation are investigated. Four distinct characteristic time regimes are identified for rating solids: ultrasmall, small, transitional, and steady state. The calculations account for birefringence due to thermally induced stress, which is shown to play a major role in the alkali halides. The optical performance of transmitting materials in various time regimes is evaluated for Gaussian beams incident on thin circular samples. Detailed quantitative ratings are presented for a wide range of transmitting materials at 10.6 micrometers. (Author Modified Abstract) GRA

N73-23577# GTE Sylvania, Inc., Mountain View, Calif.
TUNABLE VISIBLE LASER Final Report, 1 Apr. 1972 28 Feb. 1973
J. M. Yarborough Mar. 1973 56 p refs
(Contract N00014-72-C-0398; ARPA Order 1806)
(AD-756809) Avail: NTIS CSCL 20/5

The report summarizes the results of an eleven month research program to efficiently frequency double and quadruple the 1.06 microns output of a Nd:YAG laser and to use the ultraviolet output to pump an optical parametric oscillator tunable throughout the visible spectrum. During this program, average powers of 10 watts at 0.53 micron were obtained from a single CD*A second harmonic generation (SHG) crystal, with greater than 40% conversion from 1.06 microns to 0.53 micron. The green output was in the form of 0.4 joule pulses at 25 Hz. In addition green outputs of up to 0.56 joules at 10 Hz have been produced. The green output was again frequency doubled to 0.266 micron in ADP. Ultraviolet average powers of 1 watt (0.1 joule pulses at 10 Hz) were produced with a conversion efficiency of approximately 20%. The ultraviolet output was used to pump an ADP parametric generator, degenerate at 0.53 micron and tunable throughout the visible spectrum. (Author Modified Abstract) GRA

N73-23578# Catholic Univ. of America, Washington, D.C. Dept. of Chemistry.
VIBRATIONALLY EXCITED MOLECULES FOR CHEMICAL LASER Final Report, 6 Jan. 1972 - 5 Jan. 1973
Richard B. Timmons 5 Jan. 1973 11 p refs
(Contract N00019-72-C-0236)
(AD-756686) Avail: NTIS CSCL 20/5

Briefly reported are studies on elementary, exothermic, atom-molecule reactions in the hopes of discovering basic features of chemical reaction into specific internal energy vibrational modes of the reaction products. The long-range goal of such studies would hopefully be the prediction of specific chemical reactions which might be promising candidates for chemical laser systems. GRA

N73-23579# Sanders Associates, Inc., Nashua, N.H. Electro-Optics Div.
STUDIES OF THE SENSITIZATION MECHANISMS OF RARE EARTH DETECTION AND LASER MATERIALS Interim Scientific Report, 1 Apr. 1971 - 31 Mar. 1972
Evan P. Chicklis and Charles S. Naiman Feb. 1973 43 p refs
(Contract F44620-70-C-0068; AF Proj. 9768)
(AD-757520; AFOSR-73-0500TR) Avail: NTIS CSCL 20/5

The report summarizes spectroscopic studies of energy transfer in rare earths with particular attention devoted to transfer phenomena in multiply sensitized (Er-TM)Ho(3-):YLF (LiYF4). Energy transfer was studied as a function of Ho(3+) and Tm(3+) concentration and temperature. A model for the Tm-Ho transfer versus Ho and Tm concentration is presented which predicts the observed dependence of the Ho lifetime and

fluorescence yield on the Tm:Ho population ratios and the temperature. The effects of the transfer phenomena on the 2 micrometer lasing efficiency of multiply sensitized Ho:YLF (alpha beta LF) are discussed. GRA

N73-23580# Oregon Graduate Center for Study and Research, Beaverton.
PROPAGATION OF MULTIWAVELENGTH LASER RADIATION THROUGH ATMOSPHERIC TURBULENCE Quarterly Report, 15 Sep. - 15 Dec. 1972
J. Richard Kerr Griffiss AFB, N. Y. RADC 15 Jan. 1973 81 p refs
(Contract F30602-72-C-0470; ARPA Order 1279)
(AD-757562; Rept-1174-2; RADC-TR-73-54) Avail: NTIS CSCL 20/5

The report summarizes progress on three currently active efforts in the investigation of laser beam scintillations due to atmospheric turbulence. These topics are: (1) multiwavelength scintillation over a long horizontal path with a very high integrated-path turbulence level; (2) finite-beam or transmitter aperture effects including beam wander, spread, and scintillation; and (3) turbulence intermittency effects. (Author Modified Abstract) GRA

N73-23581# Naval Postgraduate School, Monterey, Calif.
AM AND FM MODULATION OF A HELIUM-NEON LASER BEAM USING ACOUSTO-OPTICA INTERACTION M.S. Thesis
Osman Unlu Dec. 1972 52 p refs
(AD-757672) Avail: NTIS CSCL 20/5

Acoustical amplitude and frequency modulation techniques of a CW helium-neon laser beam are presented. The communication possibilities of this beam for both cases (AM and FM) are verified. Theories are discussed for the acoustooptical modulator and the p-i-n silicon photodetector. Designs of the elements of the systems and experimental results are presented. Operation of both systems is discussed. Author (GRA)

N73-23582# Naval Postgraduate School, Monterey, Calif.
THE DESIGN, CONSTRUCTION, AND OPERATION OF CO2-N2-He LASER M.S. Thesis
Clarence Vernon McIntosh, Jr. Dec. 1972 45 p refs
(AD-757263) Avail: NTIS CSCL 20/5

A five-watt CO2-N2-He Laser was designed and constructed. The lasing mechanism of the CO2-N2-He gas mixture is reviewed. Beam characteristics and power output as a function of gas mixture parameters are presented. Author (GRA)

N73-23583# Illinois Univ., Urbana. Antenna Lab.
SYNTHETIC HOLOGRAMS AND IMAGE RECONSTRUCTION FROM SUBOPTICAL DIFFRACTION PATTERNS
Themistocles Haralambos Demetrakopoulos and Raj Mittra Jan. 1973 102 p refs
(Contract DAAB07-67-C-0199; Grant
DA-ARO(D)-31-124-71-G77)
(AD-756506; UIAL-72-12; UILU-ENG-72-2541;
AROD-5405-34-E) Avail: NTIS CSCL 14/5

The investigation considers some aspects of optical and digital reconstruction techniques as applied to synthetic holograms recorded with suboptical sources. The objects considered are three dimensional, comprising a sequence of planar distributions located at various depths from the hologram plane. The first part of the paper addresses itself to the problem of alleviating the longitudinal distortion that arises in optical reconstruction from suboptical holograms. The second part of the paper considers the digital approach of reconstruction that entails the application of the inverse diffraction transform to the scattered field of an object illuminated with a suboptical source. Advantages and disadvantages of the digital method vis-a-vis the optical method are discussed and both diffuse and non-diffuse types of illumination are considered. (Author Modified Abstract) GRA

N73-23584# Applied Physics Lab., Johns Hopkins Univ., Silver Spring, Md.
EXPERIMENTAL STUDIES OF A POTENTIAL PURE CHEMICAL CO2 LASER
R. E. Walker, J. C. Pirkle, C. B. Bargeron, B. F. Hochheimer, and H. L. Olsen Dec. 1972 28 p refs
(Contract N00017-72-C-4401)
(AD-757585; APL-TG-1205) Avail: NTIS CSCL 20/5

An experimental investigation is being made into a potential pure chemical CO2 laser based on the Na-catalyzed combustion of CO with N2O. Combustion takes place in a simple chain reaction, which has been verified experimentally. Various experiments have evaluated chain length, chemical kinetics, effects of diluents and stoichiometry, chemiluminescence, emission spectra, and chemical laser gain at 10.6 micrometer; the results are reviewed in the report. (Author Modified Abstract) GRA

N73-23585# Systems Science and Software, La Jolla, Calif.
THE INTERACTION OF SUSPENDED ATMOSPHERIC PARTICLES WITH LASER RADIATION Technical Report, 1 Jun. 1971 - 31 Jul. 1972
J. R. Triplett and A. A. Boni Nov. 1972 219 p refs
(Contract F29601-71-C-0085; AF Proj. 1256)
(AD-757517; SSS-R-71-1167; AFWL-TR-72-102) Avail: NTIS CSCL 07/4

The laser flux required to initiate gas breakdown is lowered when the gas contains suspended particles. Initial breakdown in either the vaporized particle or in the shock-heated adjacent gas may result in a laser-supported detonation or in a subsonic ionization wave. The nonlinear, nonequilibrium kinetic equations describing the energy distribution of free electrons, the vibrational excitation of molecules, the dominant electronic excitation, attachment, and ionization reactions and their inverses, electron heating by the laser, and electron diffusion, are solved numerically. The dominant eigenvalue of the Jacobian of these equations is investigated as a criterion for breakdown. Calculations for vaporized silica and air at temperatures from 300K to 6000K under irradiation by a CO2 laser show expected lowering of breakdown threshold for preheated material. Heating of particle vapor and subsequent formation of a shock wave are calculated with a Lagrangian gasdynamic method. Preliminary theoretical predictions for the effects of particles on lowering of the air breakdown threshold are then obtained. (Abstract Modified Abstract) GRA

N73-23586# Informatics, Inc., Rockville, Md.
EFFECTS OF HIGH POWER LASERS Report for Jul. 1971 - Dec. 1972
12 Jan. 1973 138 p refs
(Contract F44620-72-C-0053; ARPA Order 1622-3)
(AD-755820; AFOSR-73-0269TR; Rept-2) Avail: NTIS CSCL 20/5

The report is a compilation of all abstracts dealing with Soviet high-power laser technology that were published in 1972 in the monthly series on Selected Material from Soviet Technical Literature. Topics included in the report are as follows: Laser breakdown of gas, Laser interaction with plasma, Laser interaction with metals, Laser interaction with dielectrics, Laser interaction with semiconductors, Laser interaction with liquids, Laser interaction with miscellaneous materials, Theory of laser interaction with material. GRA

N73-23587# Catholic Univ. of America, Washington, D.C. Dept. of Chemistry.
INFRA-RED LASERS AND INFRA-RED SPECTRA OF FREE RADICALS Annual Report
F. X. Powell 1973 10 p
(Contract N00014-67-A-0377-0010)
(AD-758405) Avail: NTIS CSCL 20/5

The report very briefly summarizes the authors research on gas lasers including O E CS2, O E C2H2, and hot nitrogen - CO2. GRA

N73-23974* Jet Propulsion Lab., Calif. Inst. of Tech., Pasadena.
A HIGH EFFICIENCY, SMALL, SOLID STATE LASER FOR PYROTECHNIC IGNITION
L. C. Yang and V. J. Menichelli *In its* Quart. Tech. Rev., Vol. 2, No. 4 Jan. 1973 p 29-37 refs (For availability see N73-23970 14-34)
CSCL 20E

17 MATERIALS, METALLIC

Includes cermets; corrosion; physical and mechanical properties of materials; metallurgy; and applications as structural materials. For basic research see: 06 Chemistry. For related information see also: 18 Materials, Nonmetallic; and 32 Structural Mechanics.

N73-23588 Engineering Sciences Data Unit, London (England).
INFORMATION ON THE USE OF ITEMS 00.01 AND 00.02
Jul. 1972 2 p
(ESDU-00.01.00; ESDU-00.02.00) Copyright. Avail: Issuing Activity

The mathematical expressions are presented for determining the standardized stress strain curves for materials under consideration. Author

N73-23589*# National Aeronautics and Space Administration. Lewis Research Center, Cleveland, Ohio.
THEORETICAL ANALYSIS OF OXYGEN DIFFUSION AT STARTUP IN AN ALKALI METAL HEAT PIPE WITH GETTERED ALLOY WALLS
Leonard K. Tower Washington May 1973 22 p refs
(NASA-TM-X-2793; E-7352) Avail: NTIS HC $3.00 CSCL 20M

The diffusion of oxygen into, or out of, a gettered alloy exposed to oxygenated alkali liquid metal coolant, a situation arising in some high temperature heat transfer systems, was analyzed. The relation between the diffusion process and the thermochemistry of oxygen in the alloy and in the alkali metal was developed by making several simplifying assumptions. The treatment is therefore theoretical in nature. However, a practical example pertaining to the startup of a heat pipe with walls of T-111, a tantalum alloy, and lithium working fluid illustrates the use of the figures contained in the analysis. Author

N73-23590# Electrotechnical Lab., Tokyo (Japan).
STUDIES OF ALTERNATING CURRENT CORROSION OF IRON
Yutaka Torigoe Aug. 1972 56 p refs In JAPANESE; ENGLISH summary
(Rept-733) Avail: NTIS HC $5.00

An analysis of the effects of alternating current on the corrosion of iron is presented. The corrosion efficiency of iron, generation efficiency of hydrogen gas, and polarization characteristics in the alternating current electrolysis of iron in the aqueous solution of acidic and neutral salts are investigated. Under the conditions that the external polarization alternating current exceeds the spontaneous dissolution current of the iron, oxidation and reduction of the electrode are explained on the basis of the corrosion efficiency of iron under varied conditions of current frequency. Author

N73-23591# Aeronautical Research Labs., Melbourne (Australia).
FATIGUE OF ULTRA-HIGH STRENGTH STEELS: A SURVEY OF THE LITERATURE
R. Simpson and F. G. Harris Jun. 1972 55 p refs
(ARL/SM-Note-378) Avail: NTIS HC $4.75

A review of available literature on fatigue strength of ultra-high strength steels was conducted to provide a condensation of relevant data. Steels considered in the review are heat treated to ultimate tensile strength in excess of 200,000 psi. A comprehensive list of references and tabulated fatigue data are included. Author

N73-23592# Metaalinstituut TNO, The Hague (Netherlands).
A STUDY OF THE CAUSES FOR CORROSION PHENOMENA IN ANODIZED ALUMINUM SIDE PLATES OF NF 5 BOMB RACKS [EEN ONDERZOEK NAAR DE OORZAAK VAN DE CORROSIEVERSCHIJNSELEN VAN GEANODISEERDE ALUMINIUM ZIJPLATEN VAN NF 5 BOMREKKEN]
M. J. Reidt 23 Aug. 1972 7 p In DUTCH
(M72-09-96-Rei/Bla/Put) Avail: NTIS HC $3.00

Visual and microscopic studies of anodized aluminum sheets show that raw mechanical forming has an unfavorable effect on their corrosion resistance. Intercrystalline corrosion is distributed mainly at the surface where a thin anodic layer provides minimal protection and where corrosive material impurity materials are concentrated. Transl. by G.G.

N73-23593# Lockheed Missiles and Space Co., Palo Alto, Calif.
STABILITY OF A RECTANGULAR PLATE UNDER IRRADIATION
Iu. I. Remnev [1972] 3 p refs Transl. into ENGLISH from Prikl. Mekh. (Kiev), v. 8, no. 11, 1972 p 123-126
Avail: NTIS HC $3.00; National Translations Center, John Crerar Library, Chicago, Illinois 60616

The effects of neutron irradiation on thin metallic isotropic plates are outlined. Data cover changes in mechanical properties, volume expansion, and elastic constants. Pair defect accumulation is discussed in detail. Stability characteristics of the plates are also discussed. E.H.W.

N73-23594*# National Aeronautics and Space Administration. Lewis Research Center, Cleveland, Ohio.
CYCLIC AND ISOTHERMAL OXIDATION BEHAVIOR AT 1100 AND 1200 C OF Ni-20Cr, Ni-20Cr-3Mn, Ni-20Cr-3Si, AND Ni-40Cr ALLOYS
Carl E. Lowell Washington May 1973 24 p refs
(NASA-TN-D-7267; E-7321) Avail: NTIS HC $3.00 CSCL 11D

Alloys of Ni-20Cr, Ni-20Cr-3Mn, Ni-20Cr-3Si, and Ni-40Cr were cyclically oxidized at 1100 and 1200 C for up to 100 hours. Oxidation behavior was judged by sample thickness and weight change, metallography, diffraction, and microprobe analysis. The least attacked were Ni-40Cr and Ni-20Cr-3Si. The alloy Ni-20Cr-3Mn was much less attacked than Ni-20Cr, but more than the other alloys. The formation of Cr_2O_3 accounted for the increased resistance of Ni-Cr and Ni-20Cr-3Si, and the formation of $MnCr_2O_4$ accounts for the improvement in Ni-20Cr-3mn over Ni-20Cr. Author

N73-23595*# Scientific Translation Service, Santa Barbara, Calif.
ALUMINUM-GOLD INTERACTION IN THIN LAYERS
D. P. Kolesnikov, A. F. Andrushko, and Ye. I. Sukhinina Washington NASA May 1973 11 p refs Transl. into ENGLISH from Fiz. Metal. Metalloved. (Sverdlorski), v. 34, Sep. 1972 p 529-534
(Contract NASw-2483)
(NASA-TT-F-14919) Avail: NTIS HC $3.00 CSCL 11F

The reaction of contiguous films of aluminum and gold was studied at temperatures between 100-300 C with width ratios of delta Au/delta Al = 0.6-3.0. It was established that the character of the reaction and the composition of annealed films strongly depends on the temperature and time of exposure as well as the width ratio. The formation of intermetal compounds occurs with noticeable speed at 100 C. The diffusion coefficient and diffusion activation energy are evaluated by the curve of resistance change in various Au-Al width ratios. The order of magnitude of these coefficients indicates intercrystalline diffusion. Author

N73-23596*# Scientific Translation Service, Santa Barbara, Calif.
INVESTIGATION OF DISLOCATION LOCKING BY INTERSTITIAL IMPURITIES IN BCC-LATTICE METALS
T. V. Golub, T. Ya. Beniyeva, and I. G. Polotskiy Washington NASA May 1973 12 p refs Transl. into ENGLISH from Metallofiz. (Kiev), no. 42, 1972 p 106-112
(Contract NASw-2483)
(NASA-TT-F-14920) Avail: NTIS HC $3.00 CSCL 11F

The attenuation and thermal release of dislocations from Cottrell atmospheres in crystals with a body-centered cubic lattice is studied. It was found that there is a reduction of attenuation in proportion to increased heat treatment temperature. It is concluded that these processes must be studied by the internal friction method, as the internal stress created during deformation obscures the general picture in the crystal. Author

N73-23597# Advisory Group for Aerospace Research and Development, Paris (France).
HIGH TEMPERATURE CORROSION OF AEROSPACE ALLOYS
J. Stringer, ed. (Liverpool Univ.), R. I. Jaffee, ed. (Battelle Columbus Labs., Ohio), and T. F. Kearns, ed. (Naval Air Systems Command) Mar. 1973 338 p refs In ENGLISH and partly in FRENCH

Conf. held at Lyngby, Denmark, 10-12 Apr. 1972 (AGARD-CP-120) Avail: NTIS HC $19.00

Results are presented of conference discussions on the effects of high temperature corrosion and oxidation of alloys for future applications in aerospace vehicles. For individual titles, see N73-23598 through N73-23618.

N73-23598 Max-Planck-Institut fuer Physikalische Chemie, Gottingen (West Germany).

GENERAL ASPECTS OF HIGH TEMPERATURE CORROSION OF STRUCTURAL MATERIALS

Carl Wagner *In* AGARD High Temp. Corrosion of Aerospace Alloys Mar. 1973 p 3-7 refs (For availability see N73-23597 14-17)

An oxidation scale for high temperature corrosion of structural materials is examined and its requirements established. Scane requirements include: (1) low concentration of ionic defects effective in metal ion transport; (2) negligible vaporization of oxides in the scale; and (3) freedom from pores or cracks and firm adherence to underlying alloy even during rapid temperature changes. Author

N73-23599 National Gas Turbine Establishment, Pyestock (England).

THE ENVIRONMENT ENCOUNTERED BY HIGH TEMPERATURE COMPONENTS OF THE AIRCRAFT GAS TURBINE **c28**

J. E. Restall *In* AGARD High Temp. Corrosion of Aerospace Alloys Mar. 1973 p 11-30 refs (For availability see N73-23597 14-17)

A brief examination is made of the factors governing the behavior of hot components: combustion chamber, nozzle guide vanes, and turbine rotor blades, in aero engines in the absence of a hot-salt corrosion environment. The effects on components in engine trails of controlled additions of salt made to the intake air and fuel are discussed. Author

N73-23600 Societe Nationale d'Etudes et de Construction de Moteurs Aeronautiques, Corbeil (France).

MATERIALS CURRENTLY EMPLOYED IN HIGH TEMPERATURE COMPONENTS OF THE AIRCRAFT GAS TURBINE **c28**

M. Brunetaud *In* AGARD High Temp. Corrosion of Aerospace Alloys Mar. 1973 p 31-42 In FRENCH; ENGLISH summary (For availability see N73-23597 14-17)

General aspects of the high temperature components of the gas turbine are briefly reviewed, along with mechanical and chemical properties required of materials. Commercial nickel and cobalt base superalloys are reviewed in terms of their 1000-hour rupture strengths, together with some experimental alloys currently being developed. This last group includes powder metallurgy alloys, directionally solidified alloys, and alloys based on the refractory metals. Hot corrosion resistant superalloys contain high chromium contents, at the expense of high temperature strength. Designers are currently attempting to develop an intermediate group of high strength alloys with acceptable corrosion resistance complemented by aluminium-based diffusion coatings. Author

N73-23601* National Aeronautics and Space Administration, Washington, D.C.

THE ENVIRONMENT AND MATERIALS FOR GLIDE REENTRY VEHICLES **c31**

G. C. Deutsch *In* AGARD High Temp. Corrosion of Aerospace Alloys Mar. 1973 p 43-59 (For availability see N73-23597 14-17)

CSCL 22C

The environmental conditions to which a large glide reentry vehicle such as the space shuttle is subjected is discussed. A comparison is made with the state of the art for materials and structures to meet this environmental threat. The options that are available are stressed as are the areas where additional research and development is required. Author

N73-23602 Belgian Center for Corrosion Study, Brussels.

WHAT ARE THE ADVANTAGES AND LIMITATIONS IN THE USE OF EQUILIBRIUM THERMODYNAMICS FOR THE TREATMENT OF COMPLEX HIGH TEMPERATURE CORROSION REACTIONS? **c33**

M. Pourbaix *In* AGARD High Temp. Corrosion of Aerospace Alloys Mar. 1973 p 63-78 refs (For availability see N73-23597 14-17)

The conditions of thermodynamic stability of every species which may exist in a given system, whatever the complexity, may be represented by means of suitable diagrams. These enable one to predict the general conditions (temperature, pressure, composition of the gaseous phase) where a given solid or liquid compound may be stable, metastable or unstable. Three types of diagram are illustrated in which the ordinates and abscissae are respectively log P sub O2 and 1/T; RT ln P sub O2 and T; and E and T. The relative values of these methods of representation are discussed, and their applications to the studies of corrosion problems is outlined. Author

N73-23603 Orleans Univ. (France).

RELATIONS BETWEEN INITIAL METALLIC SUBSTRATE, AND FIRST STAGE OF THE REACTION AND FORMATION OF OXIDE LAYERS [RELATIONS ENTRE L'ETAT INITIAL D'UN SUBSTRAT METALLIQUE, LES PREMIERES ETAPES DE LA REACTION ET LA FORMATION DES COUCHES D'OXYDE]

J. Bardolle *In* AGARD High Temp. Corrosion of Aerospace Alloys Mar. 1973 p 79-95 refs In FRENCH; ENGLISH summary (For availability see N73-23597 14-17)

The influence of surface preparation on the state of crystallization near the metal surface is summarized, and it is noted that the damaged layer introduced by mechanical polishing can be removed by electropolishing. Several examples are quoted on the effect of surface preparation on the growth of thin oxide films. Minor impurities in the metal or at the oxidizing surface may have a marked effect on the oxidation rate, and in particular on the scale/metal adhesion; impurities may also change the ductility of the oxide. The mechanisms of the early stages of an oxidation reaction are briefly summarized, and ways in which the progress of these may affect the later oxidation are discussed. Author

N73-23604 Central Inst. for Industrial Research, Oslo (Norway).

TRANSPORT PROCESSES IN SCALES IN HIGH TEMPERATURE CORROSION **c06**

P. Kofstad *In* AGARD High Temp. Corrosion of Aerospace Alloys Mar. 1973 p 97-116 refs (For availability see N73-23597 14-17)

Scales are characterized as (1) porous; (2) dense and compact; or (3) continuous, but containing appreciable porosity or voids. Porous scales are not normally associated with protective oxidation behavior, and are not discussed; dense and compact scales are very uncommon in practice, but can usefully be discussed as a limiting ideal case. The kinetics of the growth of a scale in which the rate limiting process is the transport of reactants and electrons through the scale is very briefly summarized. The transport properties of a number of oxides are reviewed to determine which is the most desirable scale to be formed on an oxidation-resistant alloy. Although it is clear that the formation of a Cr_2O_3 layer will result in a reduction in the oxidation rate of Ni and Co, there is no doubt that the most protective scale layer would be Al_2O_3, and this is consistent with observation. There are many possible effects of impurities on diffusion rates in oxides, and the example of lower valent cations dissolving in an oxygen deficient M.O2 oxide is briefly discussed. The influence of porosity on the growth of a substantially compact scale is discussed, and it was concluded that on balance it is undesirable, often enhancing the oxidation rate and weakening the scale. Selective and internal oxidation are clearly of great importance, and the latter is associated with the solution of oxygen in the metal. The effects of the mechanism of oxygen diffusion, of pretreatment and microstructure of alloys, and of alloy composition are discussed. Some aspects of reactions involving sulphur are also reviewed. Author

N73-23605 Cranfield Inst. of Technology (England).

WHAT IS THE ROLE OF STRESS IN OXIDATION, INCLUDING BOTH EXTERNALLY-APPLIED AND GROWTH STRESSES? WHAT ARE THE MODES OF STRESS-RELAXATION? HOW DOES THERMAL CYCLING AFFECT THE STRESSES AND STRESS RELAXATION? **c32**

P. Hancock *In* AGARD High Temp. Corrosion of Aerospace Alloys Mar. 1973 p 117-128 refs (For availability see N73-23597 14-17)

The isothermal stresses generated during oxidation can be attributed to four main causes: (1) the volume ratio between the metal and the oxide formed; (2) the epitaxial relationship between the oxide and the metal; (3) composition changes in either the metal or the oxide; and (4) the influence of vacancies generated during oxidation. In any single oxidation process all of these factors may contribute, but the influence of component geometry on these processes' is often critical and invariably neglected. Mechanisms of stress relief include: cracking of the oxide film; plastic deformation of the scale; and in some circumstances, deformation of the underlying metal. The mechanisms of plastic deformation of the scales are reviewed and the effects of thermal stresses considered. Author

N73-23606 Yale Univ., New Haven, Conn. Dept. of Engineering and Applied Science.

ENVIRONMENTAL EFFECTS ON GAS/METAL REACTIONS AT ELEVATED TEMPERATURES c06

D. E. Rosner *In* AGARD High Temp. Corrosion of Aerospace Alloys Mar. 1973 p 129-144 refs (For availability see N73-23597 14-17)

To anticipate the effects of unusually severe operating conditions, or to design readily interpretable oxidation kinetic experiments, consideration is given to the conditions of convection, diffusion, and chemical change in the immediate vicinity of the gas/solid interface. Recently exploited methods are outlined for accomplishing this by combining simple conservation principles with computational techniques and experimental data developed by chemical, mechanical, and aeronautical engineers for dealing with similar physical situations. Important effects on gas/solid oxidation rates associated with gas flow rate, enthalpy, pressure, level, and/or chemical composition (especially dissociation) are discussed, both from the points of view of making reliable rate predictions based on available chemical and physical data, and designing kinetic experiments from which fundamental information can be extracted. Author

N73-23607 Ohio State Univ., Columbus.

VAPORIZATION LOSSES FROM Cr_2O_3 PROTECTIVE SCALES c06

R. A. Rapp *In* AGARD High Temp. Corrosion of Aerospace Alloys Mar. 1973 p 147-154 refs (For availability see N73-23597 14-17)

Vaporization thermodynamics and kinetics are reviewed. The vaporization of Cr_2O_3 scales occurs with the formation of CrO_3 and $Cr(OH)_2$ vapor species. The maximum possible rate of vaporization is given by the Hertz-Langmuir equation, but in the practical case the rate is limited by mass transport through a stagnant boundary layer, the thickness of which depends on the local gas velocity. In turbulent near-sonic flow the vaporization rate may therefore approach the theoretical maximum. It is suggested that the only possibility for the use of protective Cr_2O_3 scales in reactive high-velocity atmospheres is to separate the Cr_2O_3 scale from the environment by a compact and stable surface oxide which is low in the activity of Cr_2O_3. However, external spinel scales are generally spalled through thermal shock. There is considerable evidence to suggest that the formation of a protective alpha-Al_2O_3 scale effectively inhibits the evaporative loss of chromium from an alloy. Author

N73-23608 Pratt and Whitney Aircraft, East Hartford, Conn.

ON THE EFFECTS OF OXIDE DISPERSIONS AND RARE-EARTH TYPE ELEMENTS ON THE OXIDATION OF Cr AND Al-CONTAINING ALLOYS

F. S. Pettit *In* AGARD High Temp. Corrosion of Aerospace Alloys Mar. 1973 p 155-172 refs (For availability see N73-23597 14-17)

The effects of oxide dispersions and rare-earth type elements on the oxidation of alloys upon which Cr_2O_3 or Al_2O_3 scales are formed is discussed. It is shown that oxide dispersions and rare-earth type elements can both apparently affect the adherence, growth rate, and growth mechanism of Cr_2O_3 as well as the selective oxidation of chromium in alloys. In the case of alloys upon which Al_2O_3 scales are formed, however, oxide dispersions and rare-earth elements appear to affect only the adherence of the scale. The differences between effects produced by oxide dispersions and rare-earth type elements is examined. Author

N73-23609 Liverpool Univ. (England).

THE APPLICATION OF MULTICOMPONENT DIFFUSION THEORY TO THE OXIDATION AND CORROSION OF COMPLEX SUPERALLOYS

D. P. Whittle *In* AGARD High Temp. Corrosion of Aerospace Alloys Mar. 1973 p 173-200 refs (For availability see N73-23597 14-17)

The relevant phenomenological equations for multicomponent diffusion and methods of obtaining their solution are briefly presented. Possible forms which the calculated diffusion paths may adopt are indicated and the relevance of these to the oxidation and sulfation of alloys is discussed. The multicomponent diffusion equation was solved for transport in the alloy when one of the alloy components was being selectively removed by oxidation or sulfation. Two cases are considered: where the oxidant is insoluble in the alloy when the composition of the alloy/scale interface is important in determining which phase is stable in the scale, and when the oxidant is soluble and can diffuse into the alloy, possibly producing internal precipitation of sulphide or oxide. The relevant conditions for internal precipitation are also presented. In both cases, the importance of diffusional interaction is stressed. Author

N73-23610 Admiralty Materials Lab., Poole (England).

WHAT ARE THE SEPARATE AND INTERACTING ROLES OF SULPHUR, SODIUM AND CHLORIDE IN HOT CORROSION? c06

J. F. G. Conde *In* AGARD High Temp. Corrosion of Aerospace Alloys Mar. 1973 p 203-220 refs (For availability see N73-23597 14-17)

The origins of the sulfur, sodium, and chloride contaminants are discussed and the conditions existing in the gas turbine are examined. The chemistry of contaminants in the combustion environment is introduced and evidence is cited to show that in the short residence times available, gas phase sulfation of chloride is not significant. The mechanism of salt deposition in the gas turbine on nozzles and blades is considered briefly and the role of the obvious contaminants, sulfur, sodium, and chloride is examined in relation to sulfidation and accelerated oxidation. A model is suggested in which periodically extremely local non-equilibrium conditions arise on the surface of nozzles and turbine blades due to impaction of sea-salt particles. It is suggested that such conditions may permit chloride to destroy the integrity of protective scale layers under low oxygen pressure conditions existing beneath liquid sulfate deposits. Author

N73-23611 Centre National de Recherches Metallurgiques, Liege (Belgium).

WHAT ARE THE EFFECTS OF ALLOYING ELEMENTS SINGLY OR IN COMBINATION ON HOT CORROSION? c06

A. Davin and D. Coutsouradis *In* AGARD High Temp. Corrosion of Aerospace Alloys Mar. 1973 p 221-233 refs (For availability see N73-23597 14-17)

As single additions only chromium or aluminium are reported to improve the oxidation resistance of nickel and cobalt appreciably, due to their forming protective scales of Cr_2O_3 and Al_2O_3 respectively at sufficiently high concentrations. When the two elements are added together, the presence of the chromium causes a stable layer of Al_2O_3 to develop at lower aluminum concentrations than in the binary systems, due to the gettering effect of the chromium in the metal which impedes the inward diffusion of oxygen and prevents internal oxidation of the aluminum. Author

N73-23612 Naval Ship Research and Development Center, Annapolis, Md.

ARE COBALT-BASE ALLOYS INTRINSICALLY MORE RESISTANT TO HOT CORROSION THAN ALLOYS BASED ON NICKEL? c06

W. L. Wheatfall *In* AGARD High Temp. Corrosion of Aerospace Alloys Mar. 1973 p 235-254 refs (For availability see N73-23597 14-17)

A literature search was made in an effort to determine if cobalt-base alloys are intrinsically better than alloys based on

nickel relative to hot-corrosion resistance. Results of the search did not confirm whether cobalt alloys were inherently more resistant than nickel alloys. Failure to resolve this controversy was due mainly to two factors: (1) insufficient hot-corrosion data comparing pure nickel and cobalt; and (2) contradictions with regard to the roles of sulfur and the liquid sulfide phase in the hot-corrosion process. A discussion and comparison of results of a number of investigations are provided along with the listing of several questions which may serve as the basis for future research efforts to finally resolve whether or not cobalt-base alloys are intrinsically more hot-corrosion resistant than alloys based on nickel. Author

N73-23613 International Nickel Co., Ltd., Birmingham (England).
CAN FUEL ASH CORROSION BY VANADIUM BE COMBATTED BY ALLOYING OR COATING WITHOUT THE USE OF FUEL ADDITIVES?
K. J. Williams and P. J. Parry *In* AGARD High Temp. Corrosion of Aerospace Alloys Mar. 1973 p 255-266 refs (For availability see N73-23597 14-17)

Materials for nozzle guide vanes and turbine blades subject to attack by the products of combustion of vanadium-containing fuels are investigated. Previous operating experience of industrial gas turbines burning residual fuel is referred to, and current ASTM fuel specifications are considered. Relevant developments with alloys and coatings are reviewed. Recently announced alloys containing 35% - 50% chromium offer promising corrosion resistance, and an indication of the strength attainable in the 50% Cr base is given. High-chromium coatings, applied by pack-chromising have performed well in recent burner-rig tests. There is a need for more comprehensive testing of these new materials under realistic conditions, and over a range of vanadium contents. Author

N73-23614 Nancy Univ. (France).
WHAT ARE THE PROSPECTS FOR THE SUCCESSFUL APPLICATION OF COATED REFRACTORY METALS IN UNCOOLED TURBINES? [QUEL EST L'AVENIR DES ALLIAGES REFRACTAIRES PROTEGES DANS LA CONSTRUCTION DES TURBOMACHINES?]
B. Roques *In* AGARD High Temp. Corrosion of Aerospace Alloys Mar. 1973 p 269-282 refs In FRENCH; ENGLISH summary (For availability see N73-23597 14-17)

Various protective coatings are investigated to determine the most effective application for refractory metal alloys used in the structural makeup of turbine engines. The results indicated that coatings based on SiO2 and Al2O3 constitute foundations from which improved protective oxides may be developed. J.M.M.

N73-23615 Liverpool Univ. (England).
ARE THERE NEW APPROACHES TO ALLOYING WHICH MAY PRODUCE OXIDATION-RESISTANT REFRACTORY METAL ALLOYS?
J. Stringer *In* AGARD High Temp. Corrosion of Aerospace Alloys Mar. 1973 p 283-294 refs (For availability see N73-23597 14-17)

The oxidation mechanisms of Nb, Ta, Mo and W are briefly reviewed. Nb and Ta form non-protective porous scales of the pentoxides, and at the same time oxygen dissolves in the metal producing severe embrittlement. It was found that at elevated temperatures, both Mo and W form volatile oxides, and reduction in the oxidation rate requires the stabilization of a foreign oxide or the development of a protective noble metal-rich layer at the surface. Some molybdates and tungstates appear to have promising properties, and chromium-rich alloys forming Cr2O3 layers also represent significant improvements. Unfortunately, all alloys so far developed which have significantly improved oxidation resistance are also very brittle. Author

N73-23616 Aerospace Research Labs., Wright-Patterson AFB, Ohio.
PROSPECTS FOR OXIDATION RESISTANT REFRACTORY COMPOUNDS **c18**
Norman M. Tallan *In* AGARD High Temp. Corrosion of Aerospace Alloys Mar. 1973 p 295-309 refs (For availability see N73-23597 14-17)

Recent results of static and dynamic oxidation studies of materials which combine optimum resistance to corrosion, thermal shock, fracture, fatigue, etc. are presented. Particular attention is directed to the potential of such materials as ZrB2, HfB2, SiC, Si3N4 and their combinations in a range of technologically important applications, including gas turbines, hypersonic and re-entry vehicles. Relation of the details of the oxidation processes, their dependence on fabrication variables, and their effect on material performance are emphasized. The possible use of these and related high temperature materials as coatings for refractory metals and alloys is discussed. Author

N73-23617 Battelle Columbus Labs., Ohio.
CONCLUDING DISCUSSION
R. I. Jaffee and T. F. Kearns (Naval Air Systems Command) *In* AGARD High Temp. Corrosion of Aerospace Alloys Mar. 1973 p 313-314 (For availability see N73-23597 14-17)

Reaction kinetics relative to corrosion and oxidation resistance in refractory metal alloys are discussed. Emphasis is placed on the application of these alloys in the elevated temperature environments of gas turbine engines. The areas dealt with include: scale lattice defects; evaporation; diffusion; hot corrosion reaction; protective coatings; scale behavior in thermal shock; applied stresses in oxidation; effects of composition variables on scale plasticity; and testing procedures. J.M.M.

N73-23618 Battelle Columbus Labs., Ohio.
ANNEX B: NATO NATIONAL REPORTS ON HIGH TEMPERATURE CORROSION OF AEROSPACE ALLOYS: A TOPICAL LISTING OF THE RESEARCH PROGRAMS
Ian G. Wright *In* AGARD High Temp. Corrosion of Aerospace Alloys Mar. 1973 p 321-350 (For availability see N73-23597 14-17)

The data presented in this compilation represent much of the current research and development work in NATO countries on high temperature corrosion of aerospace alloys. Author

N73-23619# Naval Air Development Center, Warminster, Pa. Vehicle Technology Dept.
DETERMINATION OF TRACE ELEMENTS IN NICKEL BASE GAS TURBINE PARTS BY ATOMIC ABSORPTION SPECTROPHOTOMETRY
David P. Hornick 9 Feb. 1973 36 p
(WF00541202)
(AD-757015; NADC-73037-30) Avail: NTIS CSCL 11/6

An investigation is described to ascertain whether or not atomic absorption spectrophotometry could be used to determine the concentration of trace elements such as silver (Ag), bismuth (Bi), cadmium (Cd), and lead (Pb) in nickel base alloys such as IN100, B1900 and 713C, without interference from the constituent elements. Failed and nonfailed gas turbine parts made of the above alloys were tested to ascertain whether trace amounts of these elements could have possibly caused the early failure of these gas turbine parts. Author (GRA)

N73-23620# Solar, San Diego, Calif.
TUNGSTEN FIBER REINFORCED OXIDATION RESISTANT COLUMBIUM ALLOYS Final Report, 9 Dec. 1971 - 9 Feb. 1973
Mark J. Klein and Arthur G. Metcalfe Feb. 1973 63 p refs (Contract N00019-72-C-0230)
(AD-757380; RDR-1727-4) Avail: NTIS CSCL 11/4

High-strength, oxidation-resistant composites were developed for use in turbine engines at 2000F. A composite system with columbium alloy matrices and tungsten filaments was selected and evaluated for oxidation resistance and mechanical properties. These composites were intended for use in the coated condition with the oxidation-resistant matrix providing fail-safe protection. The coated composite with 27 volume percent reinforcement had excellent stress-rupture strength (100-hour rupture strength of 25 ksi at 2200F), elevated-temperature strength (33 ksi at 2600F), and isothermal-oxidation life (>1100 hours at 2000F). However, both the fail-safe life(e.g., 50 one-hour cycles at 2000F) varied with the composition of the matrix. With continued work, it should be possible to tailor the properties of this composite system so that desired properties can be optimized for specific high-temperature applications. Author (GRA)

N73-23621# Massachusetts Inst. of Tech., Cambridge.
STRUCTURE AND PROPERTY CONTROL THROUGH RAPID

QUENCHING OF LIQUID METALS Semiannual Technical Report, 31 Jul. - 31 Dec. 1972
Nicholas J. Grant, Regis M. Pelloux, Merton C. Flemings, and Ali S. Argon 31 Dec. 1972 129 p refs
(Contract DAHC15-70-C-0283; ARPA Order 1608)
(AD-757677; SATR-5) Avail: NTIS CSCL 11/6

The processing of billets from rapidly quenched liquid metals was investigated. Various powder metallurgy (P/M) and quench-casting techniques were employed to generate extremely fine dendrite arm spacings and homogeneous structures. Iron, nickel and cobalt-base alloy powders, produced by steam atomization (coarse powders), argon atomization, vacuum atomization, and the rotating electrode process, were consolidated into dense billets by hot isostatic pressing (HIP) and/or extrusion. The hot working properties of P/M billets and quench-cast bars were evaluated by hot rolling, high strain rate tests, and creep (superplastic) testing. Detailed analyses of microstructure, heat treatment, and mechanical properties are presented for all P/M alloys and compared to equivalent cast materials. (Author Modified Abstract) GRA

N73-23622# Naval Research Lab., Washington, D.C.
CONTRIBUTIONS OF SELECTED RESIDUAL ELEMENTS TO THE RADIATION EMBRITTLEMENT SENSITIVITY OF STEEL FORGINGS Final Report
J. Russell Hawthorne 18 Jan. 1973 18 p refs
(NRL Proj. M01-14)
(AD-756625; NRL-7526) Avail: NTIS CSCL 11/6

Residual impurity element content has a major influence on the sensitivity of low-alloy steels to radiation-induced embrittlement. The identification of phosphorus as highly detrimental to irradiation performance has made tin, arsenic, and antimony additional suspect elements. The influence of tin, arsenic, and antimony on elevated-temperature radiation-embrittlement sensitivity was expiored using a series of seven experimental NiCrMoV forgings. The forgings represented high and low phosphorus contents in addition to statistical variations of tin, arsenic, and antimony. Assessments of relative radiation sensitivity involved the exposure of Charpy-V specimens at 550F (288C) to a neutron fluence of 3.1 X 10 to the 19th power n/sq cm = 1 MeV. Author (GRA)

N73-23623# Army Foreign Science and Technology Center, Charlottesville, Va.
MECHANICAL PROPERTIES OF ALUMINUM, COPPER, TIN AND CADMIUM BASE MULTILAYER COMPOSITIONS
V. S. Kopan and A. V. Lysenko 30 Aug. 1972 5 p refs Transl. into ENGLISH from Fiz. Metal. Metalloved. (USSR), v. 29, no. 3, 1970
(AD-756616; FSTC-HT-23-327-72) Avail: NTIS CSCL 11/6

The report discusses durability of the metal films to rupture as the thickness of the films is increased. GRA

N73-23624# Maryland Univ., College Park. Engineering Materials Group.
A CONSTITUTIVE RELATION FOR DEFORMATION TWINNING IN BODY CENTERED CUBIC METALS
Ronald W. Armstrong and Peter J. Worthington Jan. 1973 21 p refs
(Contract N00014-67-A-0239-0011; NR Proj. 031-739)
(AD-757042; EMG-116) Avail: NTIS CSCL 11/6

A constitutive relation is developed to describe the grain size, temperature and strain rate dependence of the stress required for the essentially elastic twinning of body centered cubic (bcc) metals at low temperatures. The relation is derived from a description of the bulk material strain produced by twinning and, also, from specifying on the basis of a thermal activation analysis the number of twins and the twinning nucleation rate. Two natural consequences of this development for bcc metals are that twins must be nucleated by pre-twinning slip and that twinning and brittle fracture are predicted to occur under very similar circumstances. These are normal experimental observations. Author (GRA)

N73-23625# California Univ., Los Angeles. School of Engineering and Applied Science.
NEW TECHNIQUES FOR THE SYNTHESIS OF METALS AND ALLOYS Semiannual Technical Report
R. F. Bunshah Mar. 1973 36 p refs
(Contract DAHC15-70-G-15; ARPA Order 1643)
(AD-758389; UCLA-ENG-7328; SATR-5) Avail: NTIS CSCL 11/6

The report describes: (1) Preparation of Nickel foil by the high rate physical vapor deposition (HRPVD) techniques and evaluation of its properties; and, (2) Experiments on high rate deposition of Y2O3, TiC, Si3N4 by direct evaporation and of Y2O3 and Si3N4 by reactive evaporation and activated reactive evaporation. (Author Modified Abstract) GRA

N73-23626# Lehigh Univ., Bethlehem, Pa. Center for Surface and Coatings Research.
MOSSBAUER SPECTROSCOPY STUDIES OF THE PASSIVATION AND CORROSION INHIBITION OF METALS Final Report, 16 Jan. 1970 - 5 Jan. 1973
Henry Leidheiser, Jr., Gary W. Simmons, and Elsie Kellerman 2 Feb. 1973 9 p refs
(Grants DA-ARO(D)-31-124-72-G1;
DA-ARO(D)-31-124-70-G36)
(AD-757705; AROD-8154-3-MC) Avail: NTIS CSCL 11/6

Major findings in four areas were summarized: (1) application of Mossbauer spectroscopy to the study of corrosion; (2) the osication of iron as studied by conversion-electron Mossbauer spectroscopy; (3) Mossbauer spectroscopic studies in situ of the passive film on cobalt; and (4) non-destructive monitoring by Mossbauer spectroscopy of the rate of corrosion of coated metal at the metal-polymer interface. Author (GRA)

N73-23627# Army Foreign Science and Technology Center, Charlottesville, Va.
IMPACT TESTING
L. T. Timoshuk 19 Dec. 1972 18 p Transl. into ENGLISH from the mono. "Mekhanicheskie Ispytaniya" 1971 p 151-169
(AD-758252; FSTC-HT-23-360-73) Avail: NTIS CSCL 11/6

Contents: Transition of metal into brittle state; determination of impact strength; and, evaluation of brittle strength by impact tests. GRA

N73-23628# Drexel Univ., Philadelphia, Pa. Dept. of Metallurgical Engineering.
ROLE OF MICROSTRUCTURE ON ACOUSTIC EMISSION IN THE DEFORMATION OF Al-CuAl2 COMPOSITES (THE ROLE OF THE INTERFACE ON THE MECHANICAL BEHAVIOR OF METAL-MATRIX COMPOSITES)
A. Pattnaik and A. Lawley Apr. 1973 21 p refs
(Contract N00014-67-A-0406-0001; Drexel Proj. 336; NR Proj. 031-721)
(AD-758378; TR-10) Avail: NTIS CSCL 11/4

Acoustic emission has been monitored during the ambient temperature tensile deformation of directionally solidified Al-CuAl2. Attention was directed to the effect of microstructure in that a range of structures was examined ranging from lamellar to spheroidized; coarsening was promoted by elevated temperature exposure at temperatures up to 0.98T (eutectic) for times up to 100 hours (360 ks). (Author Modified Abstract) GRA

18 MATERIALS, NONMETALLIC

Includes corrosion; physical and mechanical properties of materials (e.g., plastics); and elastomers, hydraulic fluids, etc. For basic research see: 06 Chemistry. For related information see also: 17 Materials, Metallic; 27 Propellants; and 32 Structural Mechanics.

N73-23629*# Jet Propulsion Lab., Calif. Inst. of Tech., Pasadena.
CERMET COMPOSITION AND METHOD OF FABRICATION Patent Application
Wayne M. Phillips, inventor (to NASA) Filed 5 Apr. 1973 32 p
(Contract NAS7-100)
(NASA-Case-NPO-13120-1; US-Patent-Appl-SN-348422) Avail: NTIS HC $3.75 CSCL 11D

A method for fabricating cermets is presented. The physical and electrical properties of the cermets are described. The

compositions of various samples of cermets are analyzed and the specific properties are reported. NASA

N73-23630*# National Aeronautics and Space Administration, Washington, D.C.
CHEMISTRY TECHNOLOGY: ADHESIVES AND PLASTICS: A COMPILATION Technology Utilization
[1973] 25 p refs
(NASA-SP-5961(01)) Avail: NTIS HC $1.00 CSCL 11A

Technical information on chemical formulations for improving and/or producing adhesives is presented. Data are also reported on polymeric plastics with special characteristics or those plastics that were produced by innovative means. E.H.W.

N73-23631*# National Aeronautics and Space Administration. Marshall Space Flight Center, Huntsville, Ala.
OFFGASSING OF NON-METALLIC MATERIALS IN 5 psia OXYGEN
F. T. Wells and D. R. Hamilton 9 May 1973 36 p
(NASA-TM-X-64745) Avail: NTIS HC $4.00 CSCL 11D

Analysis of a wide variety on nonmetallic materials for offgassing products, including carbon monoxide and total hydrocarbons in 5 psia oxygen are reported. A general method as described in MSFC-SPEC-101B Offgassing Support Combustion. Author

N73-23632*# Lockheed Missiles and Space Co., Palo Alto, Calif.
DEVELOPMENT OF MANUFACTURING PROCESS FOR LARGE-DIAMETER COMPOSITE MONOFILAMENTS BY PYROLYSIS OF RESIN-IMPREGNATED CARBON FIBER BUNDLES
W. G. Bradshaw, P. C. Pinoli, and A. E. Vidoz 1 Oct. 1972 112 p refs
(Contract NAS3-15552)
(NASA-CR-120973; LMSC-D309742) Avail: NTIS HC $7.75 CSCL 11D

Large diameter carbon-carbon composite monofilaments were produced from the pyrolysis of organic precursor resins reinforced with strength carbon fibers. The mechanical properties were measured before and after pyrolysis and the results were correlated with the properties of the constituents. The composite resulting from the combination of Thornel 75 and GW-173 resin precursor produced the highest tensile strength. The importance of matching strain-to-failure of fibers and matrix to obtain all the potential reinforcement of fibers is discussed. Methods are described to reduce, within the carbonaceous matrix, pyrolysis flaws which tend to reduce the composite strength. Preliminary studies are described which demonstrated the feasibility of fiber-matrix copyrolysis to alleviate matrix cracking and provide an improved matrix-fiber interfacial bonding. Author

N73-23633*# Linguistic Systems, Inc., Cambridge, Mass.
THE ANOMALOUS INFLUENCED OF THE DEGREE OF CROSS LINKING OF EPOXIDE OF RESIN IN THE GLASSY STATE ON THE DYNAMIC MODULUS OF ELASTICITY
B. N. Komarov Washington NASA May 1973 9 p Transl. into ENGLISH from Vksokomol. Soedin. (USSR), v. 14, no. 11, Nov. 1972 p 804-809
(Contract NASw-2482)
(NASA-TT-F-14913) Avail: NTIS HC $3.00 CSCL 11D

The influence of the thickness of space lattice of epoxide resin ED-5 in the glassy state on the dynamic modulus of elasticity is investigated. It is shown that variation of the dynamic modulus of elasticity has an extreme nature, and a hypothesis is proposed to explain the extreme nature of the dependence of the dynamic modulus on the thickness of the space lattice. Author

N73-23634# Army Engineer Waterways Experiment Station, Vicksburg, Miss. Soils and Pavements Lab.
CONSTRUCTION OF FIBROUS REINFORCED CONCRETE OVERLAY TEST SLABS, TAMPA INTERNATIONAL AIRPORT, FLORIDA Interim Report
Frazier Parker, Jr. Oct. 1972 74 p refs
(Contract DOT-FA71WAI-218)
(FAA-RD-72-119) Avail: NTIS HC $5.75

The planning and construction of two fibrous reinforced concrete overlay test sections at TIA are described. The test sections included 4- and 6-in.-thick overlays located on a currently used parallel taxiway to one of the primary N - S runways. The test sections were inspected after about one month's traffic, and the condition of the overlays is described. Conclusions based on the construction of the test section indicate that fibrous reinforced concrete can be produced in a central mix plant and placed with a slip-form paver. Procedures and equipment for bulk handling of the fibers will have to be developed. Author

N73-23635*# Monsanto Research Corp., Dayton, Ohio.
THERMALLY RESISTANT POLYMERS FOR FUEL TANK SEALANTS Final Report, 28 Jun. 1971 - 31 Dec. 1972
James A. Webster 10 Apr. 1973 59 p refs
(Contract NAS8-21401)
(NASA-CR-124249; MRC-DA-353) Avail: NTIS HC $5.00 CSCL 11A

Imide-linked perfluoroalkylene ether polymers, that were developed for the high temperature fuel tank sealant application, are discussed. Modifications of polymer structure and properties were realized through use of a new aromatic dianhydride intermediate containing an ether-linked perfluoroalkylene segment. Tests of thermal, oxidative and hydrolytic stability, fuel resistance, and adhesion are discussed along with tensile strength and elongation results. Efforts to effect a low temperature condensation of amic acid prepolymer to form imide links inside are described. Author

N73-23636# Deutsche Forschungs- und Versuchsanstalt fuer Luft- und Raumfahrt, Brunswick (West Germany). Inst. fuer Flugzeugbau.
STRENGTH INCREASE OF HEAT-RESISTANT METAL-TO-METAL BONDED JOINTS BY COMBINING TWO ADHESIVES (ADHESIVE COMBINATION JOINT) [FESTIGKEITSSTEIGERUNG VON WAERMEBESTAENDIGEN METALLKLEBUNGEN MIT HILFE VON KLEBSCHICHTEN AUS ZWEI KLEBSTOFFEN (KOMBINATIONSKLEBUNG)]
Walter Althof 1973 70 p refs
(DLR-FB-73-22) Avail: NTIS HC $6.00; DFVLR, Porz, West Ger. 16 DM

The lap shear strength of a high temperature adhesive bonded joint is increased by an additional adhesive, which is more ductile than the high temperature adhesive. The magnitude of the strength increase and the corresponding parameters are investigated experimentally at room and elevated temperatures by static and fatigue tests. The joints consisted of aluminum and titanium adherents with various aircraft structural adhesives. The measurement of the shear stress distribution in lap joints showed the reason for the strength increase. Author (ESRO)

N73-23637# Army Foreign Science and Technology Center, Charlottesville, Va.
OPERATIONAL CHARACTERISTICS OF SELECTIVELY TRANSPARENT INSULATION
A. V. Sheklein 22 Dec. 1972 12 p refs Transl. into ENGLISH from Gelioteknika, Akad. Nauk Vz. SSR (Tashkent), no. 3, 1971 p 41-47
(AD-756558; FSTC-HT-23-2031-72) Avail: NTIS CSCL 11/2

Operation of solar energy installations under open atmospheric conditions and in various climatic belts presents extremely rigid requirements for durability of materials used. It is known that many promising structural materials, especially synthetic films, possessing good optical, weight and economical characteristics, do not find wide application, expressly because of inadequate service lifetime. The mechanical strength and chemical durability of selective, transparent insulation materials, mainly of tin oxide and indium oxide films on glass, as well as certain of their supplementary operating characteristics, were studied in this Russian report. Author (GRA)

N73-23638# Air Force Materials Lab., Wright-Patterson AFB, Ohio.
TORSIONAL TESTING OF FINE FILAMENTS. PART 1: APPARATUS AND PROCEDURES Final Technical Report, Mar. 1968 - 31 Dec. 1969
Walter H. Gloor May 1972 25 p refs
(AF Proj. 7320)
(AD-755932; AFML-TR-72-65-Pt-1) Avail: NTIS CSCL 11/5

A device is described for the torsional testing of small-diameter

single fibers. Both shear modulus and damping (internal friction) characteristics of fibers can be determined. The apparatus is suitable for fibers ranging in diameter from a few microns to over one mil. The test procedure is outlined and sample calculations of torsional properties are provided. Author (GRA)

N73-23639# Air Force Flight Dynamics Lab., Wright-Patterson AFB, Ohio.
A SURVEY OF FAILURE THEORIES OF ISOTROPIC AND ANISOTROPIC MATERIALS
R. S. Sandhu Jan. 1972 68 p refs
(AF Proj. 4364)
(AD-756889; AFFDL-TR-72-71) Avail: NTIS CSCL 11/4

A survey of various theories of strength for isotropic and anisotropic materials is presented. For anisotropic materials theories of failure are broadly classified as theories with or without distinct failure modes. The former class includes the criteria based upon maximum stress and strain while the latter are quadratic or biquadratic representations in which the transition from one failure mode to another is gradual. Author (GRA)

N73-23640# IIT Research Inst., Chicago, Ill.
DEVELOPMENT OF ENGINEERING DATA ON THE MECHANICAL AND PHYSICAL PROPERTIES OF ADVANCED COMPOSITES MATERIALS Interim Technical Report, 1 Jun. 1971 - 31 May 1972
Kenneth E. Hofer, P. N. Rao, and V. E. Humphreys Wright-Patterson AFB, Ohio AFML 1 Sep. 1972 532 p
(Contract F33615-71-C-1713; AF Proj. 7381)
(AD-757524; IITRI-D6063; AFML-TR-72-205-Pt-1) Avail: NTIS CSCL 11/4

The development of engineering data for advanced composite materials is an important step in the development of new improved hardware for future aerospace applications. With this major goal in view, the present program was initiated to generate basic data on the effect of various environmental variables on the physical, thermal, and mechanical properties of selected resin matrix and metal matrix materials. The three resin matrix materials systems are Boron/Avco 5505, Modmor II Graphite/Narmco 5206 and Courtaulds HMS Graphite/Hercules 3002M systems. The two metal matrix materials systems are 6061 Aluminum/Boron and 6Al-4V Titanium/BorSiC Composites. The resin matrix systems were procured in the form of prepreg tapes and specimens were fabricated at IITRI materials laboratory. The metal matrix composites were fabricated by vendors in laminate form and supplied to IITRI for specimen fabrication and testing.
Author (GRA)

N73-23641# Air Force Materials Lab., Wright-Patterson AFB, Ohio.
EXPERIMENTAL STUDY OF FATIGUE CRACK PROPAGATION AND RETARDATION USING POLYMETHYLMETHACRYLATE Technical Report, Sep. 1971 - Sep. 1972. M.S. Thesis
Francis J. Pitoniak Nov. 1972 80 p refs
(AD-756490; AFML-TR-72-235) Avail: NTIS CSCL 11/9

Fatigue cracks were grown in compact tension specimens of polymethylmethacrylate, a transparent polymer which was used as a model for metals. Various peak overloads applied to the constant Delta K baselines used produced changes in the baseline load crack growth rates. A study of the monochromatic light interference fringe patterns emanating from the fatigue cracks at zero load indicated that the crack surface were closed along the saw cut edge and on the free surface of the specimens. The crack surfaces were displaced in the interior of the specimen at zero load. Measurement of the crack opening displacements from the fringe patterns indicated that the crack surfaces opened on the free surface at approximately half the baseline load level for a stress ratio of approximately zero. This is in agreement with the Elber crack closure concept. Author (GRA)

N73-23642# Naval Ordnance Lab., White Oak, Md.
SILICON CARBIDE WHISKERS ON CARBON FIBERS TO IMPROVE RESIN ADHESION
Robert A. Simon 24 Jan. 1973 35 p refs
(AD-757659; NOLTR-73-7) Avail: NTIS CSCL 11/5

Whiskerizing is a process to deposit silicon carbide whiskers on carbon fibers to increase resin adhesion to the fibers. Whiskerized fibers in composites gave short beam shear strengths to 6900 n/sq cm (10,000 psi) compared to 2800 n/sq cm (4000 psi) for as-received (unwhiskered) fibers in composites. But whiskerizing weakened the fibers, resulting in a nominal 15% tensile strength reduction. Both batch and continuous processes of whiskerizing were developed, with on-stream resin impregnation also added to the continuous whiskerizing process. Whiskerized chopped fiber prepreg was investigated as a molding compound, but gave no consistent improvement over unwhiskered fiber for the same purpose. Author (GRA)

N73-23643# Aeronautical Systems Div., Wright-Patterson AFB, Ohio.
TEST AND EVALUATION OF DOUBLE BRAIDED NYLON ROPE EXTRACTION LINES Final Technical Report, Dec. 1967 - Jan. 1972
Lawrence E. Fielding Dec. 1972 71 p refs
(AF Proj. 411A; AF Proj. 410A)
(AD-757209; ASD-TR-72-80) Avail: NTIS CSCL 11/5

The current technique of using multiple layers of flat nylon webbing for construction of extraction lines has proven to require considerable detail to fabricate, is unwieldy in large sizes, and does not have a long service life. Multiple layered extraction lines when bent over connecting hardware pins fail to achieve uniform loading throughout the plies. Therefore, additional plies are needed to compensate for the strength loss. These deficiencies have promoted an investigation into using commercially available nylon double braided rope as extraction lines. This report describes the various tests performed on the nylon rope which project some operational advantages and indicate suitability of the nylon double braided rope extraction line. (Author Modified Abstract)
GRA

N73-23644# Army Electronics Command, Fort Monmouth, N.J.
A STUDY OF LEAD BARIUM NIOBATE ADDITIONS TO LEAD ZIRCONATE TITANATE PIEZOELECTRIC CERAMICS
Robert J. Fischer Jan. 1973 24 p refs
(DA Proj. 1T0-62105-A-348)
(AD-757617; ECOM-4068) Avail: NTIS CSCL 11/2

A survey is given on the development of piezoelectric lead zirconate titanate ceramics by the addition, modification, and substitution of lead niobate. Work by this laboratory, aimed at improved ceramic resonator materials, is reported in particular, additions of lead barium niobates to lead zirconate titanate. The limited solid solubility of lead barium niobate in lead zirconate titanate was found responsible for the poor piezoelectric response observed with these ceramics. A literature survey indicates that the widest range of solid solution with useful piezoelectric properties is formed by substitution of lead niobates with perovskite structure into lead zirconate titanate with tetragonal or rhombohedral structure. Author (GRA)

N73-23645# Artech Corp., Falls Church, Va.
EVALUATION OF MULTILAYER THIN FILMS Final Report, 28 Aug. 1972 - 17 Jan. 1973
Fred Ordway Mar. 1973 29 p refs
(Contract DAAK02-72-D-0223)
(AD-757723; J7114.07-FR) Avail: NTIS CSCL 11/4

Multilayer thin-film structures were prepared and tested for strength by the bulge test and, in some cases, by uniaxial tensile testing on an Instron machine with a specially designed adapter. The calculated strengths of Al_2O_3-metal specimens ranged up to 113 kpsi. Those of aluminum-copper specimens ranged from 47 to 109 kpsi, while thin single films of copper alone gave 138-328 kpsi. Bulge testing of thin blown borosilicate glass gave values of calculated stress and strain lying on straight lines with positive intercepts on the stress axis, and coincidence of curves for increasing and decreasing test pressure showed that the specimens behaved elastically. (Author Modified Abstract)
GRA

N73-23646# Naval Ordnance Lab., White Oak, Md.
STRENGTHENING OF GLASS BY AN ELECTRONIC TECHNIQUE Final Report
Donald A. Kubose, Henry A. Perry, and John E. Tydings 15 Dec. 1972 31 p refs
(SF Proj. 51-542)
(AD-757333; NOLTR-72-290) Avail: NTIS CSCL 11/2

An electroionic strengthening process for glass which produces a relatively deep surface compressive layer to preserve this strength has been examined. The process consists of using an electric field to drive large alkali ions from a molten salt bath into the glass to replace the small resident alkali ions. This exchange of ions, carried out at temperatures below the strain point of the glass, produces a compression stress on the glass surface and hence strengthens the glass. Alkali-aluminosilicate glass hemispheres (7.6 an OD, 0.4 cm. thick) and cylinders (4.7 cm diameter, 4.4 cm long) were strengthened using postassium ions from a molten potassium nitrate bath. Maximum compressive stresses on the order of 1,000,000 psi and treatment depths of 0.65 mm were obtained for the cylindrical specimens. Although high strengths were also obtained for the hemispherical specimens there was a large variation in the measured strengths in addition to a very high incidence of specimen breakage during treatment. Oxygen and hydroxyl ion attack accelerated the growth of cracks. (Author Modified Abstract) GRA

N73-23647# Gulf Electronic Systems, San Diego, Calif.
CARBON RESEARCH Semiannual Technical Report, 1 Jul. - 31 Dec. 1972
Robert J. Akins, James L. Kaae, Karl Koyama, Robert J. Price, and Hong S. Shim 31 Jan. 1973 50 p refs
(Contract DAHC15-71-C-0282; ARPA Order 1861)
(AD-757118; GULF-EL-A12500) Avail: NTIS CSCL 11/2

The objective of the present program is to investigate the deposition process in steady-state fluid beds in order to gain a better understanding of the origin of the crystal structure and morphology of a wide range of isotropic pyrolytic carbons. The report presents results on the following areas: Fluidized bed deposition studies; Structural studies; Thermal expansivity of silicon-alloyed pyrolytic carbons; Thermal conductivity of silicon-alloyed pyrolytic carbons; Fatigue; Wear caused by pure carbon disks rubbing on various carbon and metal flats; Wear caused by silicon-alloyed carbon disks; and Wear caused by metal disks rubbing on various carbon flats. GRA

N73-23648# North American Rockwell Corp., Thousand Oaks, Calif. Science Center.
NONLINEAR MATERIALS FOR ACOUSTIC SURFACE WAVE CONVOLVER
T. C. Lim, E. A. Kraut, and R. B. Thompson 1972 8 p refs
(Contract N00014-70-C-0406)
(AD-757441) Avail: NTIS CSCL 09/1

Acoustic surface wave convolution by nonlinear mixing has been observed in cubic, hexagonal and trigonal crystals. The magnitudes of the phenomenological nonlinear surface wave coupling constants are tabulated and compared with the linear electro-mechanical coupling factor 2(delta V/V). It has been found that the basal plane of PZT-8 has a larger nonlinear coupling constant than that of the commonly used Y-cut Z propagating LiNbO3. Author (GRA)

N73-23649# Army Foreign Science and Technology Center, Charlottesville, Va.
THEORY OF REINFORCED MATERIALS WITH COATINGS
G. A. VanFoFy 11 Dec. 1972 243 p refs Transl. into ENGLISH of the mono. "Teoriya Armirovannykh Materialovs Pokrytiyami" Kiev, Naukova Dumka Press, 1971 230 p
(FSTC Proj. T7023012301)
(AD-758167; FSTC-HT-23-2537-72) Avail: NTIS CSCL 11/4

The monograph presents the principles of the theory of prediction of the properties of complex reinforced materials produced by the combination of polymer or other binders and coated, antidiffusion films of glass, metal and other fibers. Models and methods of investigation of physical properties of new heat-resistant material created by selection of various binders, special coatings and continuous fiber fillers are studied. Particular attention is given to estimation of the influence of film properties on macrocharacteristics of these materials. Author (GRA)

N73-23650# Crystal Technology, Inc., Mountain View, Calif.
BARIUM SODIUM NIOBATE AS A NONLINEAR OPTICAL MATERIAL Final Technical Report, 1 Mar. 1971 - 31 May 1972
William J. Silva and Arne Rosengreen Feb. 1973 46 p refs Prepared in cooperation with Stanford Res. Inst., Menlo Park, Calif.
(Contract F33615-71-C-1369; AF Proj. 7371)
(AD-758221; AFML-TR-72-246) Avail: NTIS CSCL 20/6

Growth of barium sodium niobate crystals from twenty-five different compositions in the single phase, solid solution region of the ternary phase diagram is described. Correlations between color center formation, strain, phase-matching temperature and composition are made. Crystals grown from melts containing less than 48.5 mol percent niobium pentoxide are colorless. Results of extinction ratio measurements for crystals of one composition and SHG measurements for crystals of several compositions are given. Author (GRA)

N73-23651# Pratt and Whitney Aircraft, West Palm Beach, Fla. Research and Development Center.
EROSION RESISTANT COATING FOR TITANIUM Final Report, 30 Jun. 1971 - 30 Jul. 1972
William J. McAnally, III Jan. 1973 88 p refs
(Contract DAAG46-71-C-0173; DA Proj. 1T0-62105-A-328)
(AD-758276; PWA-FR-5243; AMMRC-CTR-73-6) Avail: NTIS CSCL 11/3

The objective of the program was to develop the application of TIKOTE-C on the Ti-6Al-4V alloy with minimum degradation of mechanical properties. The approach for accomplishing this objective was to protect the titanium microstructure with an intermediate nickel barrier, as well as to provide a ductile layer which might inhibit crack propagation. In addition, embrittling effects due to gas absorption during the coating process were minimized by using a lower process temperature. The program was divided into two major categories: (1) TIKOTE-C coating application development, and (2) extensive mechanical tests. A brief evaluation of the fatigue characteristics and erosion resistance of nickel-plated and titanium diboride-coated titanium test specimens was made. (Author Modified Abstract) GRA

N73-23652# Solar, San Diego, Calif.
EVALUATION OF COMPATIBLE TITANIUM ALLOYS IN BORON FILAMENT COMPOSITES Final Technical Report, 1 Dec. 1970 - 30 Nov. 1972
Gunther K. Schmitz and Arthur G. Metcalfe Feb. 1973 88 p refs
(Contract F33615-71-C-1150; AF Proj. 7351)
(AD-758294; RDR-1722-2; AFML-TR-73-1) Avail: NTIS CSCL 11/4

Development of a compatible titanium alloy for boron reinforced composites was completed successfully with the alloy Ti-13V-10M0-5Zr-2.5Al (Ti 1310). Properties are typical for beta alloys. Reaction rates with boron were found to be in excess of values predicted from initial research work but are adequate for primary and secondary fabrication yet leave life available for long-term (e.g., 10,000 hour) service application at 1000F. Roll-bonded two-ply tape of 25 percent boron and three-ply press-bonded sheet of 27 percent boron showed rule-of-mixture elastic moduli with strengths corresponding to failure strains of 0.006 inch/inch. Typical fabrication parameters for press bonding are 1520 degrees F/16 ksi/30 minutes. Fabrication of roll-bonded tape is a Solar developed process using higher temperatures for much shorter times (approximately 1800 degrees F for 1 second). (Author Modified Abstract) GRA

N73-23298* Allied Chemical Corp., Morristown, N.J.
HALAR FLUOROPOLYMER: A VERSATILE INSULATION MATERIAL
A. B. Robertson *In* NASA. Marshall Space Flight Center Flat Conductor Cable Symp. 8 Dec. 1972 14 p (For availability see N73-23294 14-09)
CSCL 11D

N73-23616 Aerospace Research Labs., Wright-Patterson AFB, Ohio.
PROSPECTS FOR OXIDATION RESISTANT REFRACTORY COMPOUNDS
Norman M. Tallan *In* AGARD High Temp. Corrosion of Aerospace Alloys Mar. 1973 p 295-309 refs (For availability see N73-23597 14-17)

19 MATHEMATICS

Includes calculation methods and theory; and numerical analysis. For applications see specific categories. For related information see also: 08 Computers.

N73-23653# Loughborough Univ. of Technology (England). Dept. of Transport Technology.
IMPROVED ALGORITHMS FOR CONSTRUCTING ROOT LOCI
R. J. Aird Jan. 1973 21 p refs
(TT-7303) Avail: NTIS HC $3.25

The widespread use of computers has led to the development of programs to implement manual design methods in many fields. In the design of control systems the root locus technique is extremely useful but the direct implementation of the manual rules in a computer program is inefficient. This paper describes the development of equations which by direct integration yield the root locus diagram and by a few additional items produce the transient response. Author

N73-23654# Loughborough Univ. of Technology (England). Dept. of Transport Technology.
AN IMPROVED ALGORITHM FOR FREQUENCY RESPONSE ANALYSIS
R. J. Aird Feb. 1973 24 p
(TT-7304) Avail: NTIS HC $3.25

A method is described for determining the frequency response of a linear system. By controlling the frequency steps to maintain a constant phase increment the method automatically ensures adequate resolution of resonant peaks with minimum overall computation. A FORTRAN program for the method is included in an appendix. Author

N73-23655# Vrije Universiteit, Brussels (Belgium). Dept. of Fluid Mechanics.
COMPUTATION OF INDIVIDUAL CHARCTERISTIC VALUES AND ASSOCIATED SOLUTIONS OF MATHIEU'S EQUATION
Ch. Hirsch Nov. 1972 42 p refs
(VUB-STR-1) Avail: NTIS HC $4.25

A computer program is developed which enables the computation of a characteristic value of arbitrary order of Mathieu's equation and the associated solution without the prior calculation of all characteristic values of lower order. The maximum order is 150 and the parameter Q of Mathieu's equation may range up to 10,000. The method is based on the numerical techniques for evaluation of Mathieu functions and characteristic values. The FORTRAN listings are given as well as numerical examples. Author

N73-23656# Technion - Israel Inst. of Tech., Haifa. Dept. of Aeronautical Engineering.
PERFORMANCE OF PREDICTORS WITH NON-GAUSSIAN INPUTS
S. J. Merhav and G. Silbershatz Nov. 1972 40 p refs
(TAE-167) Avail: NTIS HC $4.00

The trajectory of a maneuvering aircraft is described by piecewise constant-coefficient second-order polynomials which constitute a non-Gaussian process at the input of a linear fire control predictor. Consequently, the on-target probability which is determined by the predictor output cannot be analytically evaluated. Using this a priori assumption for the type of target trajectory, the structure of a finite-time polynomial filter is determined. By using the go-no-go characteristic of the loss function, the smoothing time of the predictor can be optimized to yield the highest possible on-target probability. The results obtained constitute their lower bounds. Their validity is verified by digital simulation of the system which shows that, on the average, they are 15% below the exact values. The results demonstrate that the finite-time polynomial predictor is superior to both systems. Author

N73-23657# Lockheed Missiles and Space Co., Palo Alto, Calif.
METHODS OF ANALYZING DISRUPTION OF TRACKING: CONCLUSION
G. V. Obrezkov and V. D. Razevig [1973] 3 p Transl. into ENGLISH from the book "Metody Analiza Sryva Slezheniia" Moscow, Sov. Radio, 1972 p 225-227
Avail: NTIS HC $3.00; National Translations Center, John Crerar Library, Chicago, Ill. 60616

A number of methods for analyzing tracking disruption most often used in practice are examined. This permits making some deductions about the possibilities of any of the methods and the expediency of its use under specific conditions. The statistical testing (Monte Carlo) method offers the greatest possibilities for analysis. With its aid, disruption characteristics for a very broad class of automatic regulation systems are determined. An essential disadvantage of the method is the need to use computers. Author

N73-23658# Lockheed Missiles and Space Co., Palo Alto, Calif.
MODELLING TRACKING SYSTEMS ON ANALOG COMPUTERS
G. V. Obrezkov and V. D. Razevig [1973]. 5 p Transl. into ENGLISH from the book "Metody Analiza Sryva Slezheniia" Moscow, Sov. Radio, 1972 p 188-194
Avail: NTIS HC $3.00; National Translations Center, John Crerar Library, Chicago, Ill. 60616

The behavior of tracking systems subjected to determined and random perturbations is described by the stochastic differential equation. An analog model along with some peculiarities in constructing the model to solve problems of tracking disruptions is given. Author

N73-23659*# Maryland Univ., College Park. Computer Science Center.
APPROXIMATION FORMULAS FOR VOCABULARY SIZE FOR THE ONE-, TWO-, AND THREE-PARAMETER RANK DISTRIBUTIONS
H. P. Edmundson, G. Fostel, I. Tung, and W. Underwood Mar. 1972 79 p refs
(Grant NGR-21-002-008; Contract N00014-67-A-0239-0004; Grant NSF GU-2061; NR Proj. 049-261)
(NASA-CR-132023; AD-744361; TR-188) Avail: NTIS HC $6.00 CSCL 12A

Error formulas are derived for the 2-parameter rank distribution approximation. The derivations of the 2- and 3-parameter rank distributions depend on the ordinary and the generalized Riemann zeta functions, respectively. Asymptotes for the family of 2-parameter rank distribution curves are determined. Tables are computed, and graphs are drawn relating parameter values to the vocabulary size for all three distributions. Author

N73-23660*# Southern Methodist Univ., Dallas, Tex.
EXACT INTERVALS AND TESTS FOR MEDIAN WHEN ONE SAMPLE VALUE POSSIBLY AN OUTLINER Final Report
Grace J. Keller (Texas Univ., Arlington) and John E. Walsh 26 Feb. 1973 7 p
(Grant NGR-44-007-028; DL-31-46-70-07; Contract N00014-68-A-0515)
(NASA-CR-131989; SMU-83-21) Avail: NTIS HC $3.00 CSCL 12A

Available are independent observations (continuous data) that are believed to be a random sample. Desired are distribution-free confidence intervals and significance tests for the population median. However, there is the possibility that either the smallest or the largest observation is an outlier. Then, use of a procedure for rejection of an outlying observation might seem appropriate. Such a procedure would consider that two alternative situations are possible and would select one of them. Either (1) the n observations are truly a random sample, or (2) an outlier exists and its removal leaves a random sample of size n-1. For either situation, confidence intervals and tests are desired for the median of the population yielding the random sample. Unfortunately, satisfactory rejection procedures of a distribution-free nature do not seem to be available. Moreover, all rejection procedures impose undesirable conditional effects on the observations, and also, can select the wrong one of the two above situations. It is found that two-sided intervals and tests based on two symmetrically located order statistics (not the largest and smallest) of the n observations have this property. Author

N73-23661*# Brown Univ., Providence, R.I. Div. of Applied Mathematics.
BIFURCATION AND STABILITY FOR A NONLINEAR

PARABOLIC PARTIAL DIFFERENTIAL EQUATION
Nathaniel Chafee 29 Mar. 1973 7 p refs
(Grants NGL-40-002-015; DA-ARO(D)-31-124-71-G12)
(NASA-CR-131896) Avail: NTIS HC $3.00 CSCL 12A

Theorems are developed to support bifurcation and stability of nonlinear parabolic partial differential equations in the solution of the asymptotic behavior of functions with certain specified properties. A. L.

N73-23662*# Maryland Univ., College Park. Computer Science Center.
PROPERTIES OF HEURISTIC SEARCH STRATEGIES
G. J. VanderBrug Jan. 1973 36 p refs
(Grant NGR-21-002-270)
(NASA-CR-131992; TR-226) Avail: NTIS HC $4.00 CSCL 12A

A directed graph is used to model the search space of a state space representation with single input operators, an AND/OR is used for problem reduction representations, and a theorem proving graph is used for state space representations with multiple input operators. These three graph models and heuristic strategies for searching them are surveyed. The completeness, admissibility, and optimality properties of search strategies which use the evaluation function f = (1 - omega)g = omega(h) are presented and interpreted using a representation of the search process in the plane. The use of multiple output operators to imply dependent successors, and thus obtain a formalism which includes all three types of representations, is discussed. Author

N73-23663# Army Engineer Waterways Experiment Station, Vicksburg, Miss.
AN N-STEP, 2-VARIABLE SEARCH ALGORITHM FOR THE COMPONENT PLACEMENT PROBLEM
Charles H. Heider Oct. 1972 69 p refs Revised
(AD-756502; CNA-PP-90-Rev) Avail: NTIS CSCL 12/2

The component placement problem is a specialization of the quadratic assignment problem that has been extensively studied for a decade and which is of considerable practical value. Recently, interest in component placement algorithms has risen primarily as a result of increased activity in the field of computer-aided design automation. The paper deals with the methodology of component placement and is based on the results of considerable operational experience. A tutorial presentation of three search placement algorithms is provided and an improved placement procedure is described which is demonstrated to be effective in generating near optimal solutions to the component placement problem. Author (GRA)

N73-23664*# Brown Univ., Providence, R.I. Div. of Applied Mathematics.
CONTINUOUS DEPENDENCE OF FIXED POINTS OF CONDENSING MAPS
Jack K. Hale 1973 12 p refs
(Grants NGL-40-002-015; AF-AFOSR-2078-71;
DA-ARO(D)-31-124-71-G12S2; AF Proj. 9769)
(NASA-CR-132021; AD-758283; AFOSR-73-0537TR) Avail: NTIS HC $3.00 CSCL 12/1

Many problems in analysis are concerned with the dependence upon parameters of fixed points of maps. For contraction mappings, criteria are relatively easy to obtain and have been known for some time. In the study of solutions of functional differential equations, more general results were needed. It is the purpose of this paper to give a rather general fixed-point theorem for condensing maps depending on a parameter, to prove continuous dependence and to indicate how many of the previous results are special cases. Author (GRA)

N73-23665# Systems Control, Inc., Palo Alto, Calif.
PARALLEL ESTIMATION FOR NONLINEAR AIR FORCE PROBLEMS Final Report
Edison T. S. Tse, Robert E. Larson, and Stephen R. McReynolds Feb. 1973 102 p refs
(Contract F44620-72-C-0026)
(AD-757240; SCI-5980-F; AFOSR-73-0441TR) Avail: NTIS CSCL 12/1

The report describes various algorithms for calculating the modal trajectory estimate, the conditional mean state estimate and the weighted least squares trajectory estimate. These algorithms are suitable for implementation in a large class of parallel computers. The report also identifies a number of theoretical and computational questions where future research should be performed. Author (GRA)

N73-23666# Michigan Univ., Ann Arbor. Dept. of Mathematics.
RESEARCH ACTIVITIES IN GRAPH THEORY Final Report
Frank Harary Mar. 1973 6 p refs
(Grant AF-AFOSR-1515-68; AF Proj. 9749)
(AD-757235; AFOSR-73-0473TR) Avail: NTIS CSCL 12/1

The report is a brief summary of the results obtained during a five year basic research effort in the theory of graphs and its application to Air Force systems design and analysis. It includes an identification of the twelve research topics which received major attention, an identification of the scientific and engineering problem areas in which theoretical results have been applied, and a listing of six books and twenty-two technical papers resulting from the grant which describe in detail the theory and methodology developed. Author (GRA)

N73-23667# Bell Aerospace Co., Buffalo, N.Y.
ADAPTIVE PROCESSING FILTERING AND DESIGN OF DIGITAL SIGNALS FOR REALTIME ANALYSIS Final Report
Lester A. Gerhardt and Kenneth W. Drake Jan. 1973 46 p refs
(Contract F44620-72-C-0036; AF Proj. 9769)
(AD-757229; Rept-9500-920270; AFOSR-73-0442TR) Avail NTIS CSCL 12/1

The application of adaptive analog filters in the continuous case is investigated in order to derive algorithms for the control of the functional parameters (frequency, bandwidth) by adaptation of the physical parameters (gains, multiplying factors). The available transforms from the continuous to the discrete domain are reviewed and the effects of the transforms on the filter parameters are considered in order to minimize the complexity of the resulting digital filters. For the discrete digital filters, the relationships of round-off, truncation and bit accuracy to the filter stability and convergence are investigated. The stability is also examined in relation to the network structure for arrangements of the delays and feedback connections other than the direct canonical form. A discrete processor based upon automata theoretic concepts is reviewed. The formal model is extended for application to noisy environments by use of its inherent flexibility in both the problem definition process and the solution realization phases. Realtime signal processing experiments are reported using the discrete processor for two recognition tasks with audio frequency signals. Several experimental techniques of statistical extension are discussed. Author (GRA)

20 METEOROLOGY

Includes climatology; weather forecasting; and visibility studies. For related information see also: 13 Geophysics; and 30 Space Sciences.

N73-23668 Freie Univ., Berlin (West Germany). Inst. fuer Meteorologie.
METEOROLOGICAL DATA, VOLUME 128, NO. 11: RESULTS OF THE SYNOPTIC SERVICE DURING 1972. DAILY AND MONTHLY WEATHER MAPS (GROUND, 500 mb, 850 mb), TABLES AND BRIEF SCIENTIFIC ARTICLES, NOVEMBER [METEOROLOGISCHE ABHANDLUNGEN. BAND 128, HEFT 11: ERGEBNISSE DES SYNOPTISCHEN DIENSTES IM JAHRE 1972. TAEGLICHE UND MONATLICHE WETTERKARTEN (BODEN, 500 mb, 850mb, TABELLEN UND KLEINERE WISSENSCHAFTLICHE AUFSAETZE]
1972 199 p In GERMAN Avail: Issuing Activity

Daily and monthly Northern Hemisphere ground level, 500 mb, height and temperature analyses of constant pressure levels for November 1972 are presented based on rawisonde and stratospheric rocket sounding data. Corresponding monthly mean maps, their variations and deviations are included as are temperature and precipitation tables for Berlin and environment. Attached scientific studies consider the difference between a

hurricane and a neutercane and describe the weather satellite NOAA. Transl. by G.G.

N73-23669# Environmental Protection Agency, Research Triangle Park, N.C.
COST OF AIR POLLUTION DAMAGE Status Report
Larry B. Barrett and Thomas E. Waddell Feb. 1973 82 p refs
(AP-85) Avail: NTIS HC $6.25

Published and unpublished estimates of the cost of air pollution damage are reviewed and national total estimates are given. In addition, cost estimates are developed for air pollution effects on human health, vegetation, materials, and residential property values. Although discussed at length, the cost of soiling from air pollution is not estimated. The total national cost in 1968 of damage resulting from air pollution was $16.1 billion, which includes $5.2 billion for residential property, $4.7 billion for materials, $6.1 billion for health, and $0.1 billion for vegetation. The cost for each effect is distributed among the several pollutants considered responsible for that effect according to their relative emissions. The same cost is distributed among the sources by their relative emmissions. No cost function relations could be developed for various levels of pollution. As a consequence, the pivotal functions of marginal benefit are precluded. The $16.1 billion figure is considered to be a reasonable, conservative estimate. Author

N73-23670# Weapons Research Establishment, Salisbury (Australia).
MEASUREMENTS OF THE BASIC ATMOSPHERIC PARAMETERS AT WOOMERA USING THE FALLING SPHERE, FEBRUARY TO JUNE 1972
P. H. O. Pearson Jan. 1973 58 p refs
(WRE-TN-787(WR/D)) Avail: NTIS HC $5.00

During the first half of 1972 falling sphere experiments were continued on a monthly basis at approximately 6 deg solar depression in the evening, about 30 min after sunset. Six results are presented for atmospheric density, temperature, pressure and wind components covering an altitude band of 30 to 100 km. Density, temperature and pressure values are compared with those given by relevant models of the atmosphere. Author

N73-23671*# National Aeronautics and Space Administration. Goddard Space Flight Center, Greenbelt, Md.
FULL NON-LINEAR TREATMENT OF THE GLOBAL THERMOSPHERIC WIND SYSTEM. PART 2: RESULTS AND COMPARISON WITH OBSERVATIONS
P. W. Blum and I. Harris Apr. 1973 73 p refs Submitted for publication
(NASA-TM-X-66234; X-621-73-106-Pt-2) Avail: NTIS HC $5.75 CSCL 04B

The inclusion effects of the nonlinear parts of the convective derivative on the resulting wind pattern are considered. A comparison is made with earlier theoretical work and with winds deduced from observations. Author

N73-23672*# Kanner (Leo) Associates, Redwood City, Calif.
INVESTIGATION OF SEASONAL TRANSITIONS IN SPRING AND IN AUTUMN IN THE MESOPAUSE REGION
W. Schroeder Washington NASA May 1973 14 p refs Transl. into ENGLISH from Beitr. Geophys. (East Germany), v. 80, no. 1, 1971 p 65-74
(Contract NASw-2481)
(NASA-TT-F-14924) Avail: NTIS HC $3.00 CSCL 04B

The beginning and end of the seasonal transitions in the mesopause region during the years 1966-1968 were analyzed on the basis of indirect methods for continually following a number of mesospheric processes (observation of noctilucent clouds from the Northern Hemisphere). It is shown that mesospheric circulation, which begins in spring in lower altitudes of the atmosphere, will reach the mesopause later. In autumn, warming (absence of noctilucent clouds) starts at the 80 km level and reaches the lower altitudes of the atmosphere during the winter months. The duration of seasonal transitions in the thermal structure of the mesopause is about 4-5 weeks; the rate of downward drift is approximately 10 km per month. Some aspects of stratospheric-mesospheric coupling are discussed. Author

N73-23673# Air Force Systems Command, Wright-Patterson AFB, Ohio. Foreign Technology Div.
USING DIRECTED DIFFERENCES IN A NUMERICAL SOLUTION OF THE SHORT TERM WEATHER FORECAST PROBLEM
V. M. Kadyshnikov 30 Jan. 1973 30 p refs Transl. into ENGLISH from Tr. Vopr. Gidrodinamicheskogo Kratkosrochnogo Prognoza Pegody i Mezometeorol. (USSR), no. 48, 1970 p 34-51
(AD-756078; FTD-MT-24-1163-72) Avail: NTIS CSCL 04/2

On the basis of full equations in hydrothermodynamics the author, using stable initial data, has formulated a finite difference model for short range weather forecasting using unidirectional time and space differences. The article discusses different methods for initial adaptation of the wind to a stipulated pressure field: geostrophic and gradient. The paper gives some results of predictions of the ground level pressure field. Author (GRA)

N73-23674# Naval Weather Service Command, Washington, D.C.
SUMMARY OF SYNOPTIC METEOROLOGICAL OBSERVATIONS. JAPANESE AND KOREAN COASTAL MARINE AREAS. VOLUME 1: AREA 1: KUSHIRO. AREA 2: TOMAKOMAI. AREA 3: SENDAI
May 1972 485 p
(AD-757107) Avail: NTIS CSCL 04/2

Tables of meteorological data are presented for observations off the Japanese coasts of Kushiro, Tomakomai, and Sendai. GRA

N73-23675# Army Coating and Chemical Lab., Aberdeen Proving Ground, Md.
A PREDICTIVE STUDY FOR DEFINING LIMITING TEMPERATURES AND THEIR APPLICATION IN PETROLEUM PRODUCT SPECIFICATIONS Final Report
John P. Doner Nov. 1972 256 p refs
(DA Proj. 1T0-62105-A-106)
(AD-756420; CCL-316) Avail: NTIS CSCL 04/2

Hourly temperature data were obtained from 340 first order weather stations located in the continental United States, Alaska, and the Panama Canal Zone. The data was processed by computer, ranked into monthly maximum and minimum percentile values, and presented in tabular form for application to maps, charts, or calculations. An additional study involving the daily minimum temperature was conducted to define the limiting temperature values associated with a 3 and 6 consecutive hour cold soak period. The purpose of this data is to allow its use in specifying lubricant properties needed in different areas. To facilitate the use of these percentile data in fuel and lubricant specificatons, isothermal maps were prepared defining geographic regions in terms of selected minimum and maximum percentile values. (Author Modified Abstract) GRA

N73-23676# Environmental Prediction Research Facility (Navy), Monterey, Calif.
A STUDY OF NUMERICAL SIMULATION OF MARITIME FOG
David M. Feit Dec. 1972 47 p refs
(AD-757328) Avail: NTIS CSCL 04/2

The paper reports the findings of an investigation into the use of a numerical advection fog model in a maritime environment. Methods of handling the fallout of liquid water and the flux of water vapor and heat are discussed, and the effect of the sea-surface temperature on fog formation is shown in a series of graphs and figures. Also discussed is the importance of wind shear and radiation with relation to the model. Several modifications to the model were tested and are described and the results of five experiments are reported. Conclusions and recommendations derived as a result of this study are presented. Author (GRA)

N73-23677# Eastern Air Lines, Inc., Miami, Fla. Engineering Dept.
AN INVESTIGATION OF A VERTICALLY SCANNING INFRARED RADIOMETER AS A CLEAR AIR TURBULENCE WARNING SYSTEM Final Report, 1 Oct. 1971 - 31 Oct. 1972
Dale N. Jones Dec. 1972 105 p refs
(Contract F19628-72-C-0086; AF Proj. 6670)
(AD-757501; AFCRL-72-0729) Avail: NTIS CSCL 04/2

Over 350 flight hours were flown on a specially instrumented

DC8-61 in regular passenger-carrying service. The aircraft was instrumented with an Infrared Clear Air Turbulence stabilized remote-temperature sensor and a digital recording system. All flights were accomplished with specially trained research observers occupying a cockpit jump-seat making detailed records of atmospheric conditions and significant events. Approximately 200 hours of cruise-level recordings were obtained and analyzed. It was found that all clear air turbulence encountered during cruise-level flight was associated with measurable horizontal temperature gradients. On the other hand, only half of the observed temperature changes were associated with vertical accelerations of -0.1 g or greater. The flight records contain meager evidence that clear air turbulence severity may be associated with the magnitude of horizontal temperature change. (Author Modified Abstract) GRA

N73-23678# Emmanuel Coll., Boston, Mass. Oriental Science Research Library.
ENVIRONMENTAL POLLUTION AND CLIMATIC CHANGE
Chotaro Nakajima et al L. G. Hanscom Field, Mass. AFCRL 9 Jan. 1973 46 p refs Transl. into ENGLISH from Tenki (Japan), v. 18, no. 9, 1971 p 453-474
(Contract F19628-71-C-0121)
(AD-757487; EMM-73-282; AFCRL-TR-73-0010; Trans-101) Avail: NTIS CSCL 04/2

The paper discusses environmental pollution and climatic change. Discussions begin on atmospheric pollution on a global scale, followed by anthropogenic modification of global climage, numerical experiment of climatic change, cooling in the Northern Hemisphere, environmental influence on the Japan climate, climatic variation related to the mass balance of perennial snow patches, and secular variation of air temperature and humidity in some suburan localities. Finally, the generalities of artificial climate control are presented. Author (GRA)

N73-23679# Air Force Cambridge Research Labs., L. G. Hanscom Field, Mass.
ON THE OPERATION VALUE OF TERMINAL WEATHER FORECASTS
C. N. Touart 12 Dec. 1972 13 p
(AF Proj. 8628)
(AD-757489; AFCRL-AFSIG-252; AFCRL-72-0719) Avail: NTIS CSCL 04/2

Real forecast verifications are used to test a Wx-85 conclusion based on synthetic data: namely, that where the climatic frequency of closed terminal weather is as low as found typically in the CONUS, then the present level of forecasting skill for periods of 3 hours or more is of negative value to aircraft operations. The new results confirm the previous conclusion for longer periods but suggest that it is unduly pessimistic with respect to the 3-hour forecast. Author (GRA)

N73-23680# Atmospheric Sciences Lab., White Sands Missile Range, N.Mex.
NUMERICAL APPROXIMATIONS OF SELECTED METEOROLOGICAL PARAMETERS RELATED TO CLOUD PHYSICS
Walter S. Nordquist, Jr. Mar. 1973 51 p refs
(DA Proj. 1T0-61102-B-53A)
(AD-757623; ECOM-5475) Avail: NTIS CSCL 04/2

Methods of computation and error estimates are presented for numerical approximation of selected meteorological parameters used in the solution of cloud physics problems. These parameters are latent heat, saturation vapor pressure, dew point and wet bulb temperatures, specific heat of liquid water, temperature of the lifting condensation level, change in mass of freely falling water drops, and saturation-adiabatic temperatures. The FORTRAN programming language listings of the approximations are provided in the appendix. Author (GRA)

N73-23681# Virginia Polytechnic Inst. and State Univ., Blacksburg. Water Resources Research Center.
CLIMATOLOGICAL SUMMARIES FOR SELECTED STATIONS IN VIRGINIA
Curtis W. Crockett Jun. 1973 165 p Sponsored by Dept. of Interior.
(PB-213881/3; VPI-WRRC-Bull-53; OWRR-A-999-VA(14)) Avail: NTIS HC $3.00 CSCL 04B

Climatological information is summarized for 74 weather stations throughout Virginia. A map locates these stations. Data cover the period 1941 to 1970 in all cases where the record exists. Specific information shown includes: maximum and minimum temperature, rainfall and snowfall, probability of temperatures below freezing, probability of precipitation, and a narrative climatological summary for each station. Author (GRA)

N73-23682# Arizona Univ., Tucson.
RECONSTRUCTION OF PAST CLIMATIC VARIABILITY Semiannual Technical Report, 1 Jul. 1972 - 1 Jan. 1973
Harold C. Fritts, M. A. Stokes, J. S. Dean, M. A. Wiseman, and C. W. Stockton 1 Jan. 1973 28 p refs
(Grant AF-AFOSR-2406-72; ARPA Order 2221)
(AD-757486; AFOSR-73-0483TR) Avail: NTIS CSCL 04/2

New ring-width chronologies are obtained for the purpose of extending the existing climate data base back in time and to a wider geographic area. A total of 139 new sites have been collected and progress on analysis is reported. Compilation of long climatic data is proceeding and multivariate models give increased predictability of climate from tree rings. Expansion of the data base to new areas in North America and Europe is being planned. Author (GRA)

N73-23683# R and D Associates, Santa Monica, Calif.
HISTORICAL CLIMATOLOGY Final Technical Report, 1 Oct. 1971 - 30 Sep. 1972
Leona M. Libby Oct. 1972 68 p refs
(Contract F44620-72-C-0025; ARPA Order 1964)
(AD-757225; RDA-TR-110-NMO; AFOSR-73-0444TR) Avail: NTIS CSCL 04/2

The research program in Historical Climatology has the general purpose to show feasibility of determining global climate in the past, by determining past trends in surface temperature of the earth. The method being studied involves measuring past temperatures using isotope thermometers in bio-organic bases. For example, isotope ratios in tree rings being formed are expected to change if the temperature changes; thus tree rings formed long ago may exhibit different ratios than those being formed today. Lower limits on the temperature coefficients have been computed, and compared favorably with experimental coefficients. New measurements of these coefficients have been undertaken in water plants. Feasibility of measurement of the isotope ratio by neutron activation for oxygen has been demonstrated and feasibility of measurement of D/H, C13/C12 and O18/O16 has been demonstrated by elastic backscatter of low energy protons. The variations of isotope ratios in two trees have been measured and the correlation with historic weather records is being studied. Author (GRA)

N73-23684# Hawaii Univ., Honolulu. Dept. of Meteorology.
RADIOSONDE SYSTEMS FOR THE STUDY OF WARM CLOUD DEVELOPMENT
Tsutomu Takahashi and Manakkampad S. Unninayar Jan. 1973 37 p refs
(Contract N00014-67-A-0387-0015; Grant NSF GA-30977)
(AD-758073; UHMET-73-01) Avail: NTIS CSCL 04/2

The design criteria, construction details and electrical circuits of three radiosonde instrument systems are presented. The electrical potential gradient radiosonde (EPGR) measures the atmospheric potential gradient (0 to plus or minus 1500 V/m) in and around warm clouds. The raindrop charge radiosonde (RCR) measures the in-cloud raindrop charge (minimum charge detectable 10 to the minus 5th power e.s.u.). The raindrop charge-size radiosonde (RCSR) measures the in-cloud raindrop size (minimum size detectable 0.6 mm), as well as the charge. Through the use of a novel switching circuit, the radiosonde systems also transmit the ambient temperature, pressure and relative humidity to the ground. Examples of the data derived from radiosonde soundings are presented. Author (GRA)

N73-23685# General Dynamics/Electronics, San Diego, Calif.
A PRELIMINARY ANALYSIS OF ERRORS IN WIND MEASUREMENTS FROM OCEAN DATA BUOYS Technical Report, Oct. 1972 - 31 Jan. 1973
D. A. Plutchak and F. D. Troxler Mar. 1973 31 p refs Sponsored in part by NSF
(Contract N00014-70-C-0180; NR Proj. 083-147)
(AD-757981; R73-005) Avail: NTIS CSCL 04/2

Errors in wind speed and direction measurement made aboard a data collection buoy are considered. Sources of error examined included sensor dynamics, signal conditioning, buoy motion, analog-to-digital conversion, and calibration. A discussion of each error source and the resulting error is made. Errors due to buoy motion were found to be small for synoptic conditions due to the pre-sample filtering of the periodic buoy motion. The most significant errors were found to be in analog velocity processing to convert speed and direction to north and east components, the pre-sample filtering, and the calibration of sensors. Digital techniques can be used in forming the north and east vector components to reduce velocity processor errors to a level of insignificance. Author (GRA)

21 NAVIGATION

Includes guidance; autopilots; star and planet tracking; inertial platforms; and air traffic control. For related information see also: 07 Communications.

N73-23686*# National Aeronautics and Space Administration. Ames Research Center, Moffett Field, Calif.
THE 4-D GUIDANCE OF STOL AIRCRAFT IN THE TERMINAL AREA
Thomas Pecsvaradi and Heinz Erzberger Oct. 1972 41 p refs
(NASA-TM-X-62234) Avail: NTIS HC $4.25 CSCL 17G

Advanced STOL aircraft for the improvement of the nation's air transportation system by the elimination of delays and congestions associated with today's air travel are discussed. A new guidance technique, referred to as 4-D guidance, is being developed for STOL aircraft. The 4-D guidance technique synthesizes complex three-dimensional flight paths from a minimum set of input and files the aircraft along the paths according to a prespecified time schedule. The two major elements of a 4-D guidance system are the trajectory synthesizer and the control law. Inputs to the trajectory synthesizer are the three-dimensional coordinates of way points, the turning radii, the speed ranges, the acceleration limits, and the arrival times at time control way points. First, the three-dimensional trajectory is computed by using circular arcs and straight lines. Then the airspeed profile, compensated for wind, is calculated to achieve the desired arrival times. The synthesized trajectory is stored as a time sequence of reference states which the aircraft is forced to track by using a linear feedback law. Author

N73-23687# National Aviation Facilities Experimental Center, Atlantic City, N.J.
AN INVESTIGATION OF ATC PROCEDURES FOR IFR APPROACHES TO TRIPLE PARALLEL RUNWAYS Final Report, Dec. 1972 - Jan. 1973
William Crimbring and G. Errol Porter May 1973 20 p
(FAA Proj. 142-177-030)
(FAA-NA-73-23; FAA-RD-73-37) Avail: NTIS HC $3.00

Air traffic control (ATC) procedures applicable to the conduct of simultaneous instrument flight rules (IFR) approaches to a set of three parallel runways were investigated. A dynamic simulation was conducted to examine the various aspects of such an operation, including ATC procedures, monitoring requirements, general controller workload limits, and a comparison of the effect of greater and lesser percentages of Mode C-equipped aircraft on monitoring procedures. Results show that the concept of conducting simultaneous instrument approaches to a set of triple parallel runways is feasible using standard ATC procedures and separation standards (except on the final approach course). Author

N73-23688# Federal Aviation Administration, Washington, D.C.
ENGINEERING AND DEVELOPMENT PROGRAM PLAN: NAVIGATION
4 Jun. 1973 55 p
(FAA-ED-04-1) Avail: NTIS HC $4.75

The development of CONUS and Oceanic Navigation Systems necessary for projected traffic loads into the 1980's is discussed. Program goals, approach, development activities, and expected results are presented. The program is based on the continuing role of VORTAC as the primary means of navigation in the airways system into the 1980's. Concurrently programs have been established to determine the feasibility for adoption of VLF systems, such as Omega, for aviation users in both oceanic and continental applications. Author

N73-23689# Advisory Group for Aerospace Research and Development, Paris (France).
AIR TRAFFIC CONTROL SYSTEMS
Apr. 1973 371 p refs In ENGLISH and FRENCH Presented at the 14th Meeting of the Guidance and Control Panel of AGARD, Edinburgh, 26-29 Jun. 1972
(AGARD-CP-105) Avail: NTIS HC $20.75

The proceedings of a conference on air traffic control developments and procedures are presented. The subjects discussed involve the following: (1) control concepts; (2) automation; (3) area and enroute navigation; (4) terminal navigation and control; (5) landing guidance; (6) surveillance; (7)communications; (8) collision avoidance; and (9) integrated communication, navigation, and identification system. For individual titles, see N73-23690 through N73-23721.

N73-23690 Electronic Systems Div., Bedford, Mass.
STATUS AND TRENDS IN MILITARY AIR TRAFFIC CONTROL SYSTEMS
Albert R. Shiely, Jr. *In* AGARD Air Traffic Control Systems Apr. 1973 3 p (For availability see N73-23689 14-21)

The status and trends in military air traffic control systems are discussed. The air navigation facilities operated by U.S. Military Forces are described. The mission of the Air Defense Control System is explained. The development of automated air control systems, airborne search radar, and integrated communication, navigation, and identification systems is reported. Author

N73-23691 Eurocontrol Agency, Brussels (Belgium).
AIR TRAFFIC CONTROL IN THE EUROCONTROL AREA
G. H. Trow *In* AGARD Air Traffic Control Systems Apr. 1973 18 p (For availability see N73-23689 14-21)

The organization and operation of the Eurocontrol area air traffic control system are discussed. The member nations comprising the organization are identified. The accomplishments of the organization are presented. The problems peculiar to European flights because of national sovereignty are analyzed. The development of an improved system of air traffic control is reported. Maps of the Eurocontrol area of operation are included. Author

N73-23692 Wilcox Electric Co., Inc., Kansas City, Mo.
DECISIONS FOR THE 70'S
Robert J. Shank *In* AGARD Air Traffic Control Systems Apr. 1973 15 p (For availability see N73-23689 14-21)

The nature of the air traffic control system and procedures during the 1970's are almost completely determined by decisions made during the past twenty years. A brief review of this already-determined baseline system and its operation is included, and a set of objectives for the future and guiding principles will provide a background for the major decisions now confronting the world air traffic control community. The important proposed changes or improvements in the areas of surveillance, navigation, communications, collision avoidance, and instrument landing are examined, and the major issues for decision are proposed. Author

N73-23693 National Aerospace Lab., Amsterdam (Netherlands).
ATC AUTOMATION, PRESENT AND FUTURE
C. G. H. Scholten *In* AGARD Air Traffic Control Systems Apr. 1973 5 p refs (For availability see N73-23689 14-21)

A number of design principles in which future air traffic control systems should differ from present systems in order to cope with increased air traffic demands are discussed. The principles are that available air space and airports should be used in as flexible a manner as possible by using computers and that improved data links between ground and air will be required for pilot-computer communication. The need for a back up system in the event of complete computer failure to allow controllers to clear existing traffic safely is proposed. Author

N73-23694 IBM Italia, Rome.
AUTOMATION OF AIR TRAFFIC CONTROL IN ITALY, ROME

CONTROL AREA
Camillo Martucci and Bruno Tincani *In* AGARD Air Traffic Control Systems Apr. 1973 10 p (For availability see N73-23689 14-21)

The physical structure and operative unit organization of the Rome, Italy air traffic control system are discussed. The automation of the system is described to include the functions and capabilities. The phases in which the automated system is being implemented are reported. Diagrams of the system components and network to show the operation of the system are provided. Author

N73-23695 Centre d'Experimentation de la Navigation Aerienne, Orly (France).
THE SAVVAN: MEANS FOR INSPECTION BY VOR AND DME [LE SAVVAN, MOYEN D'INSPECTION DES VOR ET DES DME]
Gilbert Montel *In* AGARD Air Traffic Control Systems Apr. 1973 11 p In FRENCH (For availability see N73-23689 14-21)

An evaluation is presented of the effectiveness of the SAVVAN (automatic system for vertification of navigation aids in flight) in locating and controlling high altitude aircraft. The system responds to signals from VOR and DME onboard the aircraft. Signals are registered on a magnetic band where they are processed according to a pre-established computer program. Along with the magnetic band, the system has logic elements and 12 receivers. Transl. by E.H.W.

N73-23696 Federal Aviation Administration, Washington, D.C.
STATUS AND TRENDS IN CIVIL AIR TRAFFIC CONTROL SYSTEMS
Gustav E. Lundquist *In* AGARD Air Traffic Control Systems Apr. 1973 5 p (For availability see N73-23689 14-21)

The status and trends on civil air traffic control systems are discussed. The use of automation programs to increase air traffic control safety by providing the air traffic controller with better information on which to base decisions is examined. The development of a network of computers, displays, and communications which will process, store, and distribute instrument flight rules is reported. The operation of the system is described by illustrations and block diagrams. Author

N73-23697 Singer-Kearfott, Fairfield, N.J.
AREA NAVIGATION: COST VERSUS OPERATIONAL BENEFITS
Jefferson Z. Amacker *In* AGARD Air Traffic Control Systems Apr. 1973 9 p refs (For availability see N73-23689 14-21)

Cost, complexity, and cockpit workload were compared for seven potential area navigation system configurations. Cockpit workload was found to be minimum for the very simple and most sophisticated systems. However, the sensitivity of the cost parameter is such that it increases dramatically with system complexity with relatively little gain in operational benefit. A detailed study of the Mark 1, Mark 13, and ATA Operations Committee requirements document discerned that almost all required operational functions could be accomplished with minimum systems. Author

N73-23698 Litton Systems, Inc., Woodland Hills, Calif. Aero Products Div.
AIRBORNE AREA NAVIGATION EQUIPMENT
C. S. Bridge and R. J. Holm *In* AGARD Air Traffic Control Systems Apr. 1973 13 p (For availability see N73-23689 14-21)

A broad base of area navigation equipment, manufacturers and users exists. Types of equipment extend from simple adaptation of VOR to triple inertial systems with multiple radio position inputs and digital computer processing. Air transport equipment is grouped into Mark I, Mark II and Mark 13 systems which are described. Area navigation systems are based upon, or augmented by, air data, VOR, Doppler, inertial, Loran A/C, Omega, and satellite. Demonstrations and performance in recent flight tests show state-of-the-art for area navigation systems with consideration of projected requirements. Examples of enroute navigation, vertical navigation, terminal area and landing are shown. Controls, pictorial displays, automatic data entry and data link are discussed. Author

N73-23699 Systems Control, Inc., Palo Alto, Calif.
AN ATC/SURVEILLANCE MODELING APPROACH FOR SPECIFYING LANE SEPARATION STANDARDS
J. S. Tyler, D. E. Stepner, and J. A. Sorensen *In* AGARD Air Traffic Control Systems Apr. 1973 12 p refs (For availability see N73-23689 14-21)
(Contract DOT-TSC-260)

The reduction in separation standards for both domestic and oceanic air routes because of increased travel demand is discussed. The overall problem of relating lane separations to safety for different navigation systems, surveillance systems, and air traffic control procedures are considered. A model is described which has the same general input/output format as the Reich model that has been used for specifying North Atlantic route separations. Numerical results are presented to show the impact of inertial navigation systems and satellite surveillance on the separation standards and safety for the North Atlantic route structure. Author

N73-23700 Aerospace Systems, Inc., Burlington, Mass.
ANALYSIS OF TERMINAL ATC SYSTEM OPERATIONS
Richard B. Noll, John Zvara, and Robert W. Simpson (MIT) *In* AGARD Air Traffic Control Systems Apr. 1973 15 p refs (For availability see N73-23689 14-21)
(Contract DOT-TSC-103)

The effects of automation in terminal air traffic control are analyzed with respect to the impact of the automation on the controller. The present air traffic control system based on radar information and manual techniques is discussed and compared with an advanced system which uses a computer to generate alphanumeric radar displays and automated features. A typical control operation is presented to demonstrate controller activity in both the present and an advanced system. ARTS I is used to represent the advanced air traffic control system. The principal features of ARTS I are described and the interface of the controller with the computer and the display equipment is discussed. Author

N73-23701* National Aeronautics and Space Administration. Langley Research Center, Langley Station, Va.
AN ANALYTIC STUDY OF NEAR TERMINAL AREA OPTIMAL SEQUENCING AND FLOW CONTROL TECHNIQUES
Stephen K. Park, Terry A. Straeter, and John E. Hogge *In* AGARD Air Traffic Control Systems Apr. 1973 18 p refs (For availability see N73-23689 14-21)

Optimal flow control and sequencing of air traffic operations in the near terminal area are discussed. The near terminal area model is based on the assumptions that the aircraft enter the terminal area along precisely controlled approach paths and that the aircraft are segregated according to their near terminal area performance. Mathematical models are developed to support the optimal path generation, sequencing, and conflict resolution problems. Author

N73-23702 Air Line Pilots Association, International, Washington, D.C.
A REAL WORLD SITUATION DISPLAY FOR ALL WEATHER LANDING
J. L. DeCelles, E. J. Burke, and Ken Burroughs *In* AGARD Air Traffic Control Systems Apr. 1973 9 p (For availability see N73-23689 14-21)

A flight data display for use in aircraft approach and landing under all conditions of visibility is described. The device provides airborne self-contained glide path guidance for use in visual flight conditions. In its most sophisticated form it provides total information for manual landing, or monitoring automatic landing and roll-out during reduced visibility. It is stated that the heads-up display symbology similar to that described is urgently required for see-to-land approaches and will be essential for pilot acceptance of automatic landings in actual nonvisual conditions. Author

N73-23703 Royal Aircraft Establishment, Bedford (England). Blind Landing Experimental Unit.
THE INFLUENCE OF THE FUTURE LANDING GUIDANCE SYSTEM ON INTEGRATION OF SHORT TAKE-OFF AND LANDING AND CONVENTIONAL AIR TRAFFIC AT A

MAJOR AIRPORT
Nigel H. Hughes *In* AGARD Air Traffic Control Systems Apr. 1973 17 p refs (For availability see N73-23689 14-21)

Some of the benefits to air traffic control which may result from deploying landing guidance systems are identified. The characteristics of short takeoff and landing aircraft intercept of the instrument landing system localizer and final approach path are studied and the final approach geometry is established. STOL approach sequencing requirements are defined and sequencing geometry suggested. The ability of nonvisual approach and landing guidance systems to ease air traffic control problems is discussed. Avionics developments which are required to allow aircraft to take advantage of future landing guidance systems are described. Author

N73-23704 Army Electronics Command, Fort Monmouth, N.J.
US ARMY AIR TRAFFIC MANAGEMENT NOW THROUGH 1980
Charles Grossman and Thomas E. Daniels *In* AGARD Air Traffic Control Systems Apr. 1973 11 p (For availability see N73-23689 14-21)

The requirements of an air traffic management system which will be capable of providing for the safe operation of large numbers of aircraft under instrument meteorological conditions (IMC), and thus afford the commander maximum utilization of his combat capability within reasonable constraints of money and equipment, a totally integrated ground and airborne system, are discussed. The requirements are based upon the assumption that the Army will continue to exploit and expand the air mobility concept in the future. In order to accrue the maximum benefits from such a concept the field commander must be afforded the means to effectively use his aircraft with minimum constraints. The absence of such a system currently precludes effective field exploitation of Army aircraft under adverse weather and visibility conditions, and furthermore precludes the onset of operations until weather predictions give reasonable assurance of resupply/evacuation. Author

N73-23705 Honeywell, Inc., Minneapolis, Minn. Government and Aeronautical Products Div.
FUNCTIONAL DESIGN OF MICROWAVE LANDING SYSTEM (MLS) AIRBORNE EQUIPMENT AS INFLUENCED BY GROUND EQUIPMENT CONFIGURATION AND AIRCRAFT TYPE
Donald N. Carlson and Charles L. Seacord *In* AGARD Air Traffic Control Systems Apr. 1973 10 p refs (For availability see N73-23689 14-21)

A description of a proposed microwave landing system (MLS) is presented, with particular emphasis on the functional design requirements of the airborne equipment. This system has the potential of meeting the expanded, more precise, and more complex needs generated by a growing aircraft population consisting of both conventional and unconventional (V/STOL) types. A modular approach to both ground and airborne equipment is identified as a means of achieving desired flexibility and low cost required for a truly universal system serving the full spectrum of user aircraft and aircraft types. Elements of the ground system are identified and their influence on the nature of the transmitted signal is described. Author

N73-23706 ITT Gilfillan, Inc., Van Nuys, Calif.
THE PERFORMANCE OF THE DOPPLER MICROWAVE LANDING SYSTEM IN A MULTIPATH ENVIRONMENT
R. A. Rosien and L. L. Sanders *In* AGARD Air Traffic Control Systems Apr. 1973 9 p (For availability see N73-23689 14-21)

The success of the Doppler microwave landing system in meeting the multipath challenge is described. Techniques, which can be used to eliminate the effects of multipath are described. The various multipath sources are listed together with the specific requirements for each. Performance data is given which has been gathered from three sources: (1) computer simulation; (2) laboratory tests of an equipment model; and (3) field tests on two experimental Doppler systems. The data indicates that the Doppler MLS, utilizing the simplest form of signal processing, namely, a filter and zero crossing counter, may be adequate under limited accuracy and siting conditions. For performance in heavy multipath, some form of narrowband device will probably have to be employed in order to satisfy the accuracy and minimum coverage angle requirements. Author

N73-23707 Informasjonskontroll A/S, Asker (Norway).
LANDING GUIDANCE SYSTEM: HERMES
Nils Holme *In* AGARD Air Traffic Control Systems Apr. 1973 8 p (For availability see N73-23689 14-21)

The basic principles of the landing guidance system Hermes are described. The system is based on the establishment and detection of a coded pattern of gamma radiation from radioactive sources. This principle offers a remarkable combination of high accuracy, extreme reliability and low cost, especially when applied to the final approach and runway for conventional/short takeoff and landing operations. The ground installation is purely mechanical, with no moving parts. All information is air-derived. Author

N73-23708 Royal Aircraft Establishment, Farnborough (England). Radio Dept.
A FORWARD AREA HOMING AND LANDING GUIDANCE CONCEPT FOR MILITARY AIRCRAFT
Ian M. Hunter *In* AGARD Air Traffic Control Systems Apr. 1973 8 p (For availability see N73-23689 14-21)

The characteristics of a forward area homing and landing guidance concept for military aircraft are discussed. The relative advantages of air-derived and ground-derived concepts are compared. It is concluded that a pure air-derived system cannot meet the military requirements. The development of a hybrid solution is proposed. Author

N73-23709 Aerospace Corp., Los Angeles, Calif. Development Planning Div.
THE POTENTIAL OF A SYSTEM OF SATELLITES AS A PART OF AN AIR TRAFFIC CONTROL SYSTEM
P. M. Diamond *In* AGARD Air Traffic Control Systems Apr. 1973 17 p (For availability see N73-23689 14-21)

The air traffic control (ATC) performance potential of satellite systems utilized in a data acquisition and communications role within a continental United States (CONUS) ATC system is discussed. The unique properties of satellite-based relays provide the only viable means of achieving complete coverage to ground level of the entire airspace, coupled with uniform and highly accurate surveillance position fixing. Position determination, identification, flow control, and collision avoidance functions can be implemented through the use of regional centralization of ground computation, resulting in important benefits to the utilization of the airspace and adaptability of the ATC system. It is shown that the concept of intermittent positive control (IPC) requires aircraft speed/acceleration restrictions and leads to the requirement for surveillance accuracies of 100 to 200 ft within the densely populated regions of airspace expected in the 1980s. A class of satellite systems is described which offers the requisite performance for both commercial carriers and general aviation with low anticipated costs of aircraft equipment. Author

N73-23710 Service Technique de la Navigation Aerienne, Paris (France).
TAM-TAM SYSTEM [SYSTEME TAM-TAM]
Jacques Louet *In* AGARD Air Traffic Control Systems Apr. 1973 11 p In FRENCH (For availability see N73-23689 14-21)

The TAM-TAM (automatic transmission of messages of air traffic by multiplex) system as a possible data link in air-ground-air transmission during oceanic, continental, and terminal control area flight, is discussed. Problems encountered and solutions to those problems are included. Transl. by E.H.W.

N73-23711 Mitre Corp., Bedford, Mass.
DERIVATION OF A WIDE AREA POSITION LOCATION CAPABILITY USING A SYNCHRONIZED TIME DIVISION MULTIPLE ACCESS COMMUNICATION SYSTEM
Victor A. DeMarines and R. L. Thompson (ESD) *In* AGARD Air Traffic Control Systems Apr. 1973 10 p ref (For availability see N73-23689 14-21)

A concept for the use of a high bandwidth time division communications system to provide a ground based, wide area, position location system is presented. General principles upon which the system is based and a discussion of computational

techniques employed are covered. A discussion of system behavior as a function of systematic and random errors caused by individual element position uncertainty and geometric effects is included. Control mechanisms required to produce stable and reliable performance are also described. Results of a computer simulation are presented to provide estimates of capability under various conditions and to establish the system performance envelope.
Author

N73-23712 Radio Corp. of America, Van Nuys, Calif. Electromagnetic and Aviation Systems Div.
SECANT: A SOLUTION TO THE PROBLEM OF MID-AIR COLLISIONS
J. L. Parsons *In* AGARD Air Traffic Control Systems Apr. 1973 11 p ref (For availability see N73-23689 14-21)

The principal characteristics of SECANT, a system for the separation and control of aircraft using non-synchronous Techniques, are described. This cooperative, transponding collision-avoidance system, designed to be compatible within the entire aviation community, is capable of accommodating the dense air traffic anticipated for the 1980s and beyond. It makes available to the pilot evasion or escape maneuvers in any direction - vertical, horizontal, or a combination. SECANT helps the pilot to avoid mid-air collisions by transmitting probes and receiving replies with a 1 microsecond pulse at 1000 pulses per second on 24 different frequencies. Various discriminants are used to eliminate undesired signals, and the false alarm rate is near zero. Author

N73-23713 Office National d'Etudes et de Recherches Aerospatiales, Paris (France).
A FRENCH COLLISION: AVOIDANCE SYSTEMS OF TIME-FREQUENCY TYPE. CRITICAL ANALYSIS OF TEST RESULTS
Roland Moreau *In* AGARD Air Traffic Control Systems Apr. 1973 9 p refs In FRENCH; ENGLISH summary (For availability see N73-23689 14-21)

Performance tests of a system for air traffic control and collision avoidance are discussed. The system is described and the method of operation is outlined. The precision obtained is analyzed and compared with established standards. Modifications of the signal format are examined. Problems raised by the introduction of the new air traffic control system are reported.
Author

N73-23714 Royal Air Force Inst. of Aviation Medicine, Farnborough (England).
HUMAN FACTORS PROBLEMS IN CONFLICT DETECTION AND RESOLUTION **c05**
V. D. Hopkin IN AGARD Air Traffic Control Systems Apr. 1973 6 p ref (For availability see N73-23689 14-21)

Conflict detection and resolution as human factors problems in air traffic control are discussed. It is contended that this assumption is probably incorrect, primarily because of the large differences in urgency, information, procedures and facilities in various phases of flight. The controller's responses depend on the confidence he has in the data available to him, and on his knowledge of how accurate it is likely to be. Automated aids may not be properly used if they include no indication of the accuracy, quality and comprehensiveness of the data on which automated computations are being made. Relevant research methods for human factors studies on conflict detection and resolution are indicated.
Author

N73-23715 Ferranti, Ltd., Bracknell (England). Digital Systems Div.
PROBLEMS INVOLVED IN ATC AUTOMATION
David L. Stoddart *In* AGARD Air Traffic Control Systems Apr. 1973 11 p (For availability see N73-23689 14-21)

The two major problems involved in A.T.C. automation, suitable man-machine interfaces and system reliability, are considered. These problems are placed in perspective by examining the need for automation and by considering the information required by the controller, and how this should be displayed. Suggested man-machine interfaces are examined, including synthetic plan displays, tabular displays, touchwires, keyboards, rolling balls and light pens. The operational and technical advantages and disadvantages of these devices are discussed. The problem of reliability is introduced and the need for fail safe systems explained. Various methods of achieving reliability are considered, including triplicated hardware, and systems having preferred and reconfigured functional organization. The implications of these systems are discussed and a system design suggested.
Author

N73-23716 Defence and Civil Inst. of Environmental Medicine, Downsview (Ontario).
THE MAN-COMPUTER INTERFACE PROBLEM IN TERMINAL AUTOMATION
Leslie Innes *In* AGARD Air Traffic Control Systems Apr. 1973 5 p refs (For availability see N73-23689 14-21)

The main concern in the several large air traffic control automation programs which have been implemented has been the provision of information to the controller in a more accurate and more easily assimilable form. The aim was, if not to reduce the controller's workload, to at least keep it within acceptable limits. Experience with these systems to date is reviewed, and the conclusion reached that in few instances has this aim been achieved. Without adequate isolation of the controller from the requirement to continually interact with the computer, workload is inevitably increased to an unacceptable degree, due to the additional tasks imposed on the controller by the demands of the automated aspects of the system. The development of the Canadian Forces automated terminal control concept involved evaluation of several methods of simplified man-computer interaction, carried out within constraints imposed by limited available manpower in the controller trade, and limited funding for the program. A solution has been developed which appears to adequately act as a compromise between these conflicting requirements.
Author

N73-23717 Laboratoire Central de Recherches Thomson-CSF, Orsay (France).
INTEGRATION OF COMMUNICATION FUNCTIONS, NAVIGATION, IDENTIFICATION, AND TRAFFIC CONTROL [INTEGRATION DES FONCTIONS DE COMMUNICATION, DE NAVIGATION, D'IDENTIFICATION ET DE CONTROLE DE TRAFIC]
Lj. Milosevic and P. Mollie (Service Tech. des Telecomm. de l'Air) *In* AGARD Air Traffic Control Systems Apr. 1973 11 p In FRENCH (For availability see N73-23689 14-21)

The economic aspects of replacing separate aircraft landing and anticollision equipment with an integrated time-frequency system are discussed in detail. A comparison was also made of the relative cost value of replacing equipment mounted on the aircraft.
Transl. by E.H.W.

N73-23718 Department of Transportation, Washington, D.C.
SATELLITE CONSIDERATIONS IN FUTURE AIR TRAFFIC CONTROL SYSTEMS
D. E. Findley *In* AGARD Air Traffic Control Systems Apr. 1973 9 p (For availability see N73-23689 14-21)

A program for improving the air traffic control system of the United States is discussed. The program is involved with deployment and implementation of major improvements for certain enroute and terminal area air traffic control functions. Development efforts are proposed for the following subjects: (1) traffic surveillance; (2) conflict prediction; (3) resolution and avoidance; (4) landing guidance; and (5) automation of air traffic control functions. The background for the formulation of a concept of the air traffic control system for the 1980 time period and beyond is considered. Emphasis is placed on the use of artificial satellites to meet the air traffic demands.
Author

N73-23719 TRW Systems Group, Redondo Beach, Calif.
CONCEPTUAL ANALYSIS OF ICNI SYSTEMS
J. H. Craigie *In* AGARD Air Traffic Control Systems Apr. 1973 7 p refs (For availability see N73-23689 14-21)

The development of an improved communications, navigation, and identification (ICNI) system for command and control, air traffic control, and mission execution is discussed. The program is mainly directed toward the requirements of four major Air Force Commands. The special requirements for each type of Air Force mission are analyzed to show the variations required in the proposed system.
Author

N73-23720 Mitre Corp., Bedford, Mass.
A PRACTICAL DESIGN OF AN ICNI SYSTEM
C. Eric Ellingson *In* AGARD Air Traffic Control Systems Apr. 1973 14 p (For availability see N73-23689 14-21)

The key factors which have resulted in the proliferation of communications, navigation, and identification equipment in aircraft are discussed. The advantages of interconnective communications capability and common position location capability in reducing complexity of the system while improving operational capability are examined. A specific candidate communication system is proposed and its capabilities are analyzed. Author

N73-23721 Office of the Secretary of Defense (Research and Engineering), Washington, D.C.
INTEGRITY OF ICNI SYSTEMS
Robert Lyle Linden *In* AGARD Air Traffic Control Systems Apr. 1973 3 p (For availability see N73-23689 14-21)

An analysis of integrated communications, navigation, and identification systems for aircraft operation is presented. Advances in electronics, solid state devices, logic circuits, and discrete function modules are described to show application to systems integration. The anticipated improvements in operational capability through system integration are analyzed. Author

N73-23722# Center for Naval Analyses, Arlington, Va. Systems Evaluation Group.
POSITION FINDING IN THE PRESENCE OF PARAMETRIC UNCERTAINTY
Peter J. Butterfly Jan. 1973 23 p refs
(Contract N00014-68-A-0091)
(AD-756251; SEG-Research-Contrib-229) Avail: NTIS CSCL 17/7

The report contains a two-part discussion, the first being a review of previously established results in a general treatment of position finding, the object of which is to establish comprehensive procedures applicable to all of the Navy's position finding problems. This review illustrates how such problems are influenced by quantities that appear as parameters in the formulation of the problem. The second part extends the treatment to the case where knowledge of these quantities is uncertain. Author (GRA)

N73-23723# Air Force Academy, Colo. Frank J. Seiler Research Lab.
GYRO NOISE MEASUREMENTS IN A FAMILY OF INSTRUMENTS Final Task Report, Jun. - Oct. 1972
Dennis W. Gilstad Jan. 1973 94 p refs
(AF Proj. 7904)
(AD-756977; SRL-TR-73-0001) Avail: NTIS CSCL 17/7

Noise data from a family of 8 gyros are presented with an explanation of how the data were obtained. The instruments tested were six Kearfott Alpha II and two Sperry SYG-1000 gyros. Spectral analysis of filtered, time domain data is used to provide power spectral density and integrated power spectral density plots of both rate and angle outputs. All data were taken with the gyros in the torque to balance mode, and the closed torquer loop response was adjusted in each case to be essentially flat to 15-25Hz. Each gyro was tested with IA, OA, and SA vertical and, in addition, wheel-off data are included for each position in which wheel-on data were obtained. The methods of data analysis and presentation are intended to facilitate comparisons among the gyros and aid in the separation of noise due to the gyro and its support electronics from that due to base motion. Author (GRA)

N73-23724# Army Electronics Command, Fort Monmouth, N.J.
COASTLINE INDUCED LORAN-C ANOMALIES
Chester W. Anderson, III, Douglas C. Pearce, and John W. Walker Feb. 1973 21 p refs
(DA Proj. 1T0-61102-B-31A)
(AD-757142; ECOM-4075) Avail: NTIS CSCL 17/7

In order to achieve better accuracy in position determinations when Loran-C manpack and airborne systems are used in proximity to land-sea boundaries, a program was initiated to measure the Loran-C environment in the vicinity of the Montauk Point coastline. Analysis of the lines of constant time difference over small areas showed the resultant variations to be local in extent and magnitude. It was concluded that these variations are probably a consequence of the incidence of the Loran-C pulse on the coastline. Author (GRA)

N73-23725# Applied Physics Lab., Johns Hopkins Univ., Silver Spring, Md.
HYBRID SIMULATION FOR THE STUDY OF LORAN-C SIGNAL PROCESSING TECHNIQUES
P. F. Bohn and C. J. Nisson Jan. 1973 38 p refs
(Contract N00017-72-C-4401)
(AD-757586; APL-TG-1208) Avail: NTIS CSCL 17/7

The Loran-C navigation system operates in a complex signal environment that contributes significantly to the system's reduced accuracy and reliability for ground position determination. The paper discusses a hybrid simulation that has been conceived to study this problem. The method used was to develop a signal-processing technique that would recognize and discard corrupt data. The analog computer was used to generate timing pulses and perform 5 mirosecs in-phase and quadrature integrations of the Loran-C signal. The results of the integration were stored in the digital computer for processing. The goal was to achieve a positioning accuracy of 10 ns, an order of magnitude improvement over that of equipment presently available. Author (GRA)

N73-23895 Societe Nationale Industrielle Aerospatiale, Paris (France).
INERTIALESS FLIGHT METHODS [PROCEDE DE SURVOL NON INERTIEL]
P. J. Bigeon, J. Langlois, and R. Berrqir *In* AGARD Automation in Manned Aerospace Systems Mar. 1973 19 p In FRENCH (For availability see N73-23881 14-31)

N73-23896 Royal Aircraft Establishment, Farnborough (England).
THE EXPERIMENTAL EVALUATION OF AUTOMATED NAVIGATION SYSTEMS
J. G. Carr *In* AGARD Automation in Manned Aerospace Systems Mar. 1973 13 p (For availability see N73-23881 14-31)

22 NUCLEAR ENGINEERING

Includes nuclear reactors and nuclear heat sources used for propulsion and auxiliary power. For basic research see: 24 Physics, Atomic, Molecular, and Nuclear. For related information see also: 03 Auxiliary Systems; and 28 Propulsion Systems.

N73-23726*# Atomics International, Canoga Park, Calif.
S8DR SHIELD EXAMINATION Final Report
D. G. Mason and W. R. McCurnin Jan. 1973 53 p refs
(Contract NAS3-15705)
(NASA-CR-121157; AI-73-31) Avail: NTIS HC $4.75 CSCL 18I

The SNAP 8 developmental reactor lithium hydride shield was examined after being irradiated for over 7000 hours at relatively low temperature. A crack was located in the seam weld of the containment vessel, probably the result of hot short cracking under thermal stress. The LiH was visually examined at two locations and its appearance was typical of low temperature irradiated LiH. The adherence of the chrome oxide emittance coating was found to be excellent. Author

N73-23727*# Atomics International, Canoga Park, Calif.
NaK LOOP TESTING OF THERMOELECTRIC CONVERTER MODULES (SNAP PROGRAM)
J. L. Johnson 21 May 1973 39 p refs Sponsored in part by NASA
(Contract AT(04-3)-701)
(NASA-CR-121192; AI-AEC-13099) Avail: NTIS HC $4.00 CSCL 18I

The history of testing of compact tubular modules in flowing NaK loops is summarized. Test procedures, data handling, and instrument calibration are discussed. Also included is descriptive information of the test facilities, operational problems encountered, and some recommendations for testing. Author

N73-23728# Mathematical Applications Group, Inc., Elmsford, N.Y.
ANTE 3: A FORTRAN COMPUTER CODE FOR THE SOLUTION OF THE ADJOINT NEUTRON TRANSPORT EQUATION BY THE MONTE CARLO TECHNIQUE Final Report
Martin O. Cohen and Mendel Beer Oct. 1972 80 p refs
(Contract DASA01-70-C-0102)
(AD-756290; MR-7028; DNA-2988F) Avail: NTIS CSCL 18/11

ANTE 3 is a FORTRAN code designed to solve the time-dependent neutron transport equation in a three-dimensional geometry by the adjoint Monte Carlo technique. The code uses point energy cross section data derived from the ENDF 3 libraries. In addition to theoretical discussions, a complete description of computer input and output is presented. ANTE 3 is written in FORTRAN 4 and is presently operational on a CDC-6600 digital computer. Author (GRA)

23 PHYSICS, GENERAL

Includes acoustics, cryogenics, mechanics, and optics. For astrophysics see: 30 Space Sciences. For geophysics and related information see also: 13 Geophysics, 20 Meteorology; and 29 Space Radiation.

N73-23729# Institute for Perception RVO-TNO, Soesterberg (Netherlands).
THE INTERCHANGEABILITY OF EARMUFF CUSHIONS WITH RESPECT TO THE SOUND ATTENUATION
A. M. Mimpen 1973 11 p In DUTCH; ENGLISH summary
(A72/KLu/078)
(IZF-1973-1) Avail: NTIS HC $3.00

With twelve subjects, the sound attenuation as a function of frequency was determined for the Willson 250 earmuff with the originally mounted ear cushions and with the cushions of the Safe-T-Earmuff. Selectively the noise-pressure level was measured with a miniature microphone fixed near the ear entrance of the subject, who was situated in a constant noise field. The differences in the individual results were significant for the lower frequencies at 5 percent level, but not for the higher frequencies. Author

N73-23730# Institute for Perception RVO-TNO, Soesterberg (Netherlands).
SPATIAL CHARACTERISTICS OF CHROMATIC INDUCTION, THE SEGREGATION OF LATERAL EFFECTS FROM STRAYLIGHT ARTIFACTS
J. Walraver [1973] 33 p refs
(IZF-1972-19) Avail: NTIS HC $3.75

Chromatic induction as a function of the spatial relationship between test and inducing field was measured by the method of maintaining a constant yellow hue of the test field. Red annular surrounds were used, that were either flashed simultaneously with the test field of presented as steady backgrounds. In both conditions lateral effects were observed that clearly demonstrated the importance of spatial parameters of the inducing field. On the basis of experimental evidence and existing straylight data, however, it shown that in the case of stationary surrounds these lateral effect can be completely attributed to light scatter. This finding made it possible to correct the contrast data for straylight and also yielded as a subsidiary result a modified glare formula with an extended range to glare angles in the order of a few minutes of arc. Author

N73-23731# Technisch Physisch Dienst TNO-TH, Delft (Netherlands).
ON COMPUTING THE COEFFICIENTS OF THE RAYLEIGH SERIES FOR AXIAL SYMMETRIC SCATTERING OF LONG SOUND WAVES BY A TORUS
P. F. Hummelgens 16 Jun. 1972 39 p refs
(Rept-208.138/1) Avail: NTIS HC $4.00

The scattering of long sound waves by a torus is considered. The surface of the torus is assumed to be locally reacting and to be generated by rotating a twice continuously differentiable closed contour around the y-axis. The case is studied where the incident field and the surface admittance show circular symmetry around this axis. It is shown explicitly how the integral equations for the diverse terms of the low frequency expansion of the total sound pressure at the torus surface can be solved numerically. The continuation into the farfield is obtained by an extension of Rayleigh's orginal method in terms of a sequence of well defined boundary value problems for harmonic functions. Author

N73-23732# Ruhr Univ., Bochum (West Germany). Abteilung fuer Elektrotechnik.
FLUCTUATIONS IN SENSITIVITY TO SPECTRAL LUMINOSITY Ph.D. Thesis [SCHWANKUNGEN DER SPEKTRALEN HELLEMPFINDUNG]
Guenter Dannhauer 1971 95 p refs In GERMAN
Avail: NTIS HC $6.75

Anomaloscopic photometric measurements on optical sensitivity to flicker stimuli with varying degrees of relative spectral luminosity do not substantiate the theory of seasonal and monthly fluctuation effects on human brightness sensitivity. Transl. by G.G.

N73-23733# National Oceanic and Atmospheric Administration, Boulder, Colo.
DOPPLER SPECTRUM ANALYSIS USING A MINICOMPUTER
Raymond A. Greenwald Jul. 1972 68 p refs
(NOAA-TR-ERL-241-AL-7) Avail: SOD $0.85

The interfacing and programming is described of a minicomputer for Doppler spectrum analysis. The interfaces include analog-to-digital converters for data input and digital-to-analog converters for display of the Doppler spectra on an XY oscilloscope. These interfaces are contained in the computer chassis which has the dimensions of a suitcase. The software that is included in this report is specifically written for 64 point Doppler spectra. The fast Fourier transform algorithm is used in the analysis, and the time required to transform a 64 point array is 23 milliseconds. Control of the spectral analysis program is by means of 16 data switches on the front panel of the computer. Author

N73-23734*# New Mexico Univ., Albuquerque. Technology Applications Center.
NOISE POLLUTION RESOURCES COMPENDIUM TAC Bibliographic Series No. 2
31 Dec. 1972 257 p refs
(Contract NASw-2399)
(NASA-CR-131988) Avail: NTIS HC $15.00 CSCL 20A

A compendium is presented of documents on noise. The articles presented are categorized in the following sections: noise sources, noise detection and measurement, noise abatement and control, physical effects of noise, psychological and physiological effects of noise, noise regulations and standards, patents and contracts, and noise research. F.O.S.

N73-23735*# National Aeronautics and Space Administration. Langley Research Center, Langley Station, Va.
MEASURED AND CALCULATED TRANSMISSION LOSSES OF SOUND WAVES THROUGH A HELIUM LAYER
Thomas D. Norum Washington May 1973 25 p refs
(NASA-TN-D-7230; L-8744) Avail: NTIS HC $3.00 CSCL 20A

An experiment was performed to measure the transmission losses of sound waves traversing an impedance layer. The sound emanated from a point source and the impedance layer was created by a low-speed helium jet. The transmission losses measured were of the order of 12 db for frequencies of the source between 4 and 12 kHz. These losses are greater than those predicted from analysis when the observer angle is less than about 35 deg, but less than those predicted for larger observer angles. The experimental results indicate that appreciable noise reductions can be realized for an observer shielded by an impedance layer, irrespective of his position relative to the source of sound. Author

N73-23736# Texas Univ., Austin. Applied Research Labs.
FOCUSING OF AN N WAVE BY A SPHERICAL MIRROR
Edward P. Cornet 19 Sep. 1972 102 p refs
(Contracts N00014-70-A-0166-0004; F44620-71-C-0015;

AF Proj. 9781)
(AD-757035; ARL-TR-72-40) Avail: NTIS CSCL 20/1

An experimental and theoretical study of N-wave focusing has been carried out. An N-wave source (electric spark) was located on the principal axis of a spherical mirror so as to produce a focus (image point) beyond the center of curvature. The signals before, at, and beyond the focus were received by a wideband condenser microphone of our own manufacture. Linear theory in the form of the Kirchhoff integral was used to obtain predicted waveforms. Corrections for known nonlinear propagation effects were applied. The data are explained adequately by the composite theory. An analysis of the frequency response of the wideband condenser microphone is included. (Author Modified Abstract) GRA

N73-23737# Texas Univ., Austin. Applied Research Labs.
AN EXPERIMENTAL INVESTIGATION OF THE PARAMETRIC ARRAY IN AIR
Mary B. Bennett 22 Jan. 1973 113 p refs
(Contracts F44620-71-C-0015; N00014-70-A-0166-0004; AF Proj. 9781)
(AD-757034; ARL-TR-73-3) Avail: NTIS CSCL 20/1

The results of an experimental investigation of the parametric array in air are presented and analyzed. This experiment was designed to yield quantitative data regarding both the propagation and directivity characteristics of the parametric array in air under the conditions of collinear source beams and spherical spreading. The characteristics of the sum frequency and second harmonic components as well as the difference frequency component of the parametric array were investigated. GRA

N73-23738# Office of Naval Research, London (England).
TRENDS IN PHYSICS: A REPORT ON THE 2D GENERAL CONFERENCE OF THE EUROPEAN PHYSICAL SOCIETY
I. Estermann 14 Feb. 1973 14 p Conf. held at Wiesbaden, 3-6 Oct. 1972
(AD-757261; ONRL-C-21-72) Avail: NTIS CSCL 05/2

The Second General Conference of the European Physical Society took place in Wiesbaden, Germany, from 3 to 6 October 1972. The theme of the Conference was announced as Trends in Physics, but very prominent among the discussions was the relationship between Physics and Society. The program consisted of nine plenary sessions which are reported in detail in the following pages, and fifteen divisional sessions always five in parallel - distributed over three afternoons, at which subjects more limited in scope were presented. (Author Modified Abstract) GRA

N73-23739# Ballistic Research Labs., Aberdeen Proving Ground, Md.
A MODEL FOR PREDICTING THE SPECTRAL IRRADIANCE ON A GROUND TARGET FROM THE SUN AND THE CLEAR DAYTIME SKY
Alan R. Downs Sep. 1972 62 p refs
(DA Proj. 1T0-61102-B-11A)
(AD-757149; BRL-MR-2221) Avail: NTIS CSCL 17/5

A single-scattering atmospheric radiative transfer model is derived and described. This model, based only on ground level measurements, can be used to predict the spectral and directional characteristics of radiation incident on a ground target from the sun and the cloudless daytime in the absence of discontinuities such as inversion layers. Wavelengths from 0.4 to 1.7 microns are considered. The model makes use of available information on the scattering and absorbing properties of atmospheric constituents and the distribution of these constituents with altitude. The final result is in the form of a function that can be integrated by computer to determine the spectral irradiance on the target from a preselected segment of the clear daytime sky. Detailed discussions of error sources and model limitations are included. Author (GRA)

N73-23740# Ballistic Research Labs., Aberdeen Proving Ground, Md.
VACUUM ULTRAVIOLET RADIATION IN THE EXPANSION TUBE
Fritz H. Oertel, Jr. Nov. 1972 27 p refs
(DA Proj. 1T0-61102-A-33D)
(AD-757150; BRL-MR-2249) Avail: NTIS CSCL 16/3

The findings are presented of an optical survey of vacuum ultraviolet (VUV) radiation emitted from the shock layer of a 1 to 1/2 in. diameter sphere in hypersonic flows of air argon, nitrogen and argon nitrogen mixtures. Free stream velocities of 17,000 to 20,000 ft/sec and densities corresponding to altitudes of about 90,000 ft were obtained in the BRL expansion tube facility; steady flow conditions prevailed over the model for about 75 microsec. The radiation was recorded on sensitized film down to a lower limit of 1100A. The purpose of the survey was to explore the feasibility of using this facility to measure time and space resolved radiation of the nonequilibrium, vibrationally-excited N2 in the shock layer. Methods and problems of measuring VUV from this shock layer are discussed. Author

N73-23741# City Univ. of New York. Dept. of Physics.
ADVENTURES IN GREEN'S LAND: LIGHT SCATTERING IN ANISOTROPIC MEDIA
M. Lax and D. F. Nelson Feb. 1973 35 p refs Prepared in cooperation with Bell Telephone Labs., Inc., Murray Hill, N. J.
(Contract N00014-72-A-0406-0003; NR Proj. 016-124)
(AD-757070; TR-2) Avail: NTIS CSCL 20/6

Since the scattering volume in a crystal in a typical Brillouin scattering experiment using laser excitation is small but finite, solution of the wave equation by a Green's function technique is most convenient. Two things greatly complicate such a calculation: (1) the optical anisotropy of the crystal leads to nonspherical wave surfaces (even in the far field) and to noncollinearity of the propagation and energy flow vectors and (2) detection of the scattered light outside the crystal requires the inclusion of a crystal surface in the radiation problem. Two mutally consistent approaches to this problem are presented. First, a far field Green's function inside the crystal is calculated. The detected power outside the crystal is then calculated from it and the surface coupling factors - solid angle expansion, scattering volume demagnification and transmissivity. Second, a far field Green's function outside the crystal is calculated for several cases. A scattered power formula valid outside the crystal, which applies to crystals of any symmetry and orientation, to any scattering angle, and to fairly general surface orientations, is then presented. (Author Modified Abstract) GRA

N73-23742# Maryland Univ., College Park. Dept. of Electrical Engineering.
THE STUDY OF THE INTERACTION OF INTENSE PICOSECOND LIGHT PULSE WITH MATERIALS: A THEORY OF THIRD HARMONIC GENERATION IN AN ISOTROPIC NONLINEAR MEDIUM ULTRASHORT LIGHT PULSES Quarterly Technical Report, 22 Sep. - 26 Dec. 1972
Chi H. Lee and David W. Coffey 15 Jan. 1973 63 p refs
(Grant DA-ARO(D)-31-124-71-G82; ARPA Order 675)
(AD-757211; TR-012) Avail: NTIS CSCL 20/6

The report contains the development of a theory for third harmonic generation (THG) due to broad band optical pulses such as existing in the picosecond time region. The theory is then applied to several examples. Specifically, Maxwell's equations are used as the starting point and a wave equation for the THG is developed for a uniform plane wave in a dielectric, isotropic medium. The material parameters considered are the nonlinear susceptibility giving rise to the third harmonic, the respective phase and group velocities, and the interaction length. Three examples consisting of a sine wave, a Gaussian pulse and a linearly chirped pulse are evaluated. Author (GRA)

N73-23743# Massachusetts Inst. of Tech., Cambridge. Dept. of Mechanical Engineering.
INVESTIGATION OF JET NOISE USING OPTICAL HOLOGRAPHY Interim Report, Mar. 1971 - Mar. 1972
Richard F. Salant Jun. 1972 66 p refs
(Contract DOT-TSC-146)
(PB-214112/5; DOT-TSC-146-1) Avail: NTIS HC $3.00 CSCL 20A

Holographic interferograms have been made of a cold, laboratory scale, supersonic jet in the Mach number range of 2.1 to 3.4. These holograms demonstrate that the acoustic field in the vincinity of such a jet is dominated by mach waves, each of which can be traced back to a generating disturbance within the jet. The Mach waves are generated from an axial position slightly downstream of the nozzle exit to a position

near the tip of the potential core. Measurements of mach angle indicate that the average convection velocity of the generating disturbances is approximately 90 percent of the jet velocity. The disturbances appear to be coherent instabilities rather than turbulent eddies, and extend into the potential core.
Author (GRA)

N73-23744# Georgia Univ., Athens. Dept. of Physics and Astronomy.
CALCULATIONS OF REFLECTED ACOUSTIC FLUX PATTERNS FOR SOUND RAYS ORIGINATING AT THE OCEAN SURFACE AND REFLECTED FROM UNDERWATER OBJECTS Final Report, 12 Jun. - 31 Dec. 1972
Donald G. Burkhard and David L. Shealy 28 Feb. 1973 65 p refs
(Contract N00014-67-A-0309-0002)
(AD-757110) Avail: NTIS CSCL 20/1

A formula is derived for the acoustic intensity reflected by an object of arbitrary shape embedded in a medium of variable index of refraction. Formulas are applicable in the ray acoustics limit. As specific applications, contours of equal intensity are calculated over a plane parallel to the ocean surface and over a plane perpendicular to the ocean surface when a plane wave of sound is reflected from ellipsoidal objects at various depths and distances from the receiver planes. Author (GRA)

N73-23745# Air Force Inst. of Tech., Wright-Patterson AFB, Ohio. School of Engineering.
SURFACE CURRENTS ON A CONDUCTING SPHERE DUE TO A NON-ISOTROPIC EMITTED PULSE OF ELECTRONS M.S. Thesis
James J. Harvey, Jr. Mar. 1973 108 p refs
(AD-757190; GA/PH/73-1) Avail: NTIS CSCL 20/3

Equations for the surface currents on a perfectly conducting sphere are developed in terms of the motion of a pulse of electrons emitted from the exterior surface of the sphere. The motions of the emitted electrons are determined self-consistently by using Green's function techniques to solve for the electric and magnetic fields in the space surrounding the sphere. The problem assumes that the electrons are emitted non-relativistically with azimuthal symmetry, and that the fields are essentially quasi-static in character. The resulting integral equations are solved using a mixture of analytical and numerical techniques. A specific example is worked out assuming uniform emission over one hemisphere by a delta function pulse of electrons with an energy distribution in the kev range. The results are presented graphically for a variety of emission currents, and it was found that this technique will provide useful results for emission pulse densities below 10 coulombs per square meter. Author (GRA)

N73-23746# General Electric Co., Schenectady, N.Y. Research and Development Center.
CRYOGENIC SYSTEMS AND SUPERCONDUCTIVE POWER Semiannual Technical Report, 1 Jun. - 30 Nov. 1972
B. D. Hatch, R. B. Fleming, D. W. Jones, S. H. Minnich, and D. L. Kerr 20 Dec. 1972 294 p refs
(Contract DAHC15-72-C-0235; ARPA Order 2200)
(AD-758431; SRD-73-022; SATR-1) Avail: NTIS CSCL 13/10

The specific objectives of this program are the following: Conduct a limited but broad application survey of multiple applications in which the use of cryogenic and superconductive systems and components offer substantial advantages through improvements in the performance of propulsion, communication, detection or weapons systems. Define, investigate, and experimentally evaluate the key elements of a representative cryogenic turborefrigerator subsystem suitable for providing reliable long-lived cryogenic refrigeration for a superconductive ship propulsion system. Provide a sound technical basis for subsequent applications of superconductive power in the area of ship propulsion. (Author Modified Abstract) GRA

24 PHYSICS, ATOMIC, MOLECULAR, AND NUCLEAR

Includes atomic, molecular and nuclear physics. For applications see: 22 Nuclear Engineering. For related information see also: 29 Space Radiation.

N73-23747# Tokyo Univ. of Education (Japan). Dept. of Physics.
A REGGE POLE MODEL OF CHARGE EXCHANGE AND HYPERCHARGE EXCHANGE REACTIONS
Masakatsu Kenmoku and Tomonori Kuroda 1973 22 p refs
(TUETP-73-4) Avail: NTIS HC $3.25

The forward negative pion proton yields eta meson neutron, pion nucleon- and kaon nucleon-charge and hypercharge exchange processes are studied by using pion nucleon isospin one exchange amplitudes and assuming a Regge pole model with daughter trajectories. It seems useful and helpful to assume the existence of the low lying trajectories even if they are not confirmed. Also assumed are: SU(3) relations among the amplitudes of pion nucleon- and kaon nucleon-charge and hypercharge exchange scatterings, the validity of the (rho meson + rho meson') amplitudes in medium and high energy regions, and that the mass differences between (rho meson, A2) and (kaon resonance, kaon double resonance) and between the daughters (rho meson', A2') and (kaon resonance', kaon double resonance') in (ii) are equal, respectively. Author

N73-23748# Tokyo Univ. of Education (Japan). Dept. of Physics.
A POSSIBLE EXPLANATION OF INCLUSIVE SPECTRA AT LARGE TRANSVERSE MOMENTUM
Sunao Sakai Feb. 1973 15 p refs
(TUETP-73-6) Avail: NTIS HC $3.00

The inclusive spectra at large transverse momentum in central region are used to explain the decay of massive resonances. In order to fit the data, a sequence of massive resonances is necessary with delta m = 5 to approximately 6 GeV. Possible candidates for them are H- and SH-quanta found by cosmic ray experiments. Author

N73-23749# Electrotechnical Lab., Tokyo (Japan).
EXCHANGE INTERACTIONS IN MAGNETICALLY DILUTED NICKEL FLUORIDES
Yuji Yamaguchi Aug. 1972 61 p refs In JAPANESE, ENGLISH summary
(Rept-734; UDC-537.611:537.622) Avail: NTIS HC $5.25

Experimental determinations are reported of the next-nearest- and the nearest-neighbor exchange interaction constants between Ni2(+) ions in KMgF3, K2MgF4, KZnF3 and K2ZnF4 by two methods of electron spin resonance and magnetic susceptibility measurements, and some discussions on the relation between the exchange interaction in the magnetically diluted salts and the one in KNiF3 and K2NiF4, typical three-dimensional and two-dimensional antiferromagnets respectively. Author

N73-23750*# Linguistic Systems, Inc., Cambridge, Mass.
CHEMICAL SHIFTS OF AMINO GROUP PROTONS AND THE HYBRID STATE OF THE NITROGEN ATOM
Ye. V. Titov and L. M. Kapkan Washington NASA May 1973 7 p refs Transl. into ENGLISH from Dokl. Akad. Nauk SSSR (Moscow), v. 208, no. 3, 1973 p 658-661
(Contract NASw-2482)
(NASA-TT-F-14893) Avail: NTIS HC $3.00 CSCL 20H

The nuclear magnetic resonance method was used to study the chemical shifts of amino group protons and the hybrid state of the nitrogen atom in a primary amino group. The s-nature of the N-H bonds is determined. Author

N73-23751*# Linguistic Systems, Inc., Cambridge, Mass.
SHORT-RANGE FORCES OF THE INTERACTION OF COMPLEX MOLECULES
V. B. Leonas and A. V. Sermyagin Washington NASA May 1973 15 p refs Transl. into ENGLISH of "Korotkodeystvuyushchiye sily Vzaimodeystviya Slozhnykh Mokekul", Acad. of Sci., Inst. for Space Res., Moscow, Pr-129, 1972 18 p
(Contract NASw-2482)
(NASA-TT-F-14898; Pr-129) Avail: NTIS HC $3.00 CSCL 20H

Measurements of the differential scattering of H and O atoms in CH4 are conducted. The problem of determining anisotropic interaction potentials of complex systems including CH4 molecules is examined. The results of measurements of integral and differential cross sections are interpreted on the basis of the additive model. Agreement of calculations and measurements could not be reached for the scattering of chemically active atoms (H, O) in methane. Author

N73-23752*# Techtran Corp., Silver Spring, Md.
COLLISION WITH SODIUM ATOMS IN ONE OF THE TWO 3 P2 STATES
R. Seiwert Washington NASA May 1973 34 p refs Transl. into ENGLISH from Ann. Phys. (Leipzig), series 6, v. 18, 1956 p 54-79
(Contract NASw-2485)
(NASA-TT-F-14853) Avail: NTIS HC $3.75

Attempts are made to clarify measuring discrepancies in the study of two D lines radiated into pure sodium vapor, a sodium vapor air mixture, and a sodium potassium vapor mixture. Results show that the intensity ratios of the two resonance lines in fluorescent light is markedly influenced by the radiation diffusion and that the measured values therefore depend on the geometry of the system. If this is taken into account, the apparent contradiction between other experimental studies can be explained. Author

N73-23753# Joint Inst. for Lab. Astrophysics, Boulder, Colo.
ADVANCED INTERDISCIPLINARY RESEARCH IN THE DEFENSE APPLICATIONS OF LABORATORY ASTROPHYSICS Semiannual Technical Status Report, Aug. 1972 - Jan. 1973
A. V. Phelps and S. J. Smith Feb. 1973 39 p refs
(Contracts DAHC04-72-C-0047; DA-31-124-ARO(D)-139; ARPA Order 492)
(AD-757721; AROD-10827-5-P) Avail: NTIS CSCL 07/4

The report summarizes research on the following: Modeling of ionized gas systems; Stability of discharges in weakly ionized gases; Scattering and transport of resonance radiation; Radiation hydrodynamics; Plasma statistics; Transport coefficients and reaction rates; Electron transport and ionization coefficients; JILA information analysis center; Electron transport in mercury vapor; Negative ion kinetics; Atomic and radiation interaction theory; and Alkali-inert gas line broadening and intermolecular potentials. GRA

25 PHYSICS, PLASMA

Includes magnetohydrodynamics. For applications see: 28 Propulsion Systems.

N73-23754*# National Aeronautics and Space Administration. Goddard Space Flight Center, Greenbelt, Md.
NONLINEAR INTERACTION OF A FAST MAGNETOGASDYNAMIC SHOCK WITH A TANGENTIAL DISCONTINUITY
Fritz Manfred Neubauer Brunswick Tech. Univ. Brunswick 1973 47 p refs
(NASA-TM-X-69178; GAMMA-23-46S) Avail: NTIS HC $4.50 CSCL 20I

A basic problem, which is of considerable interest in geoastrophysical applications of magnetogasdynamics, is the nonlinear interaction of a fast shock (S sub f) with a tangential discontinuity (T). The problem is treated for an arbitrary S sub f interacting with an arbitrary T under the assumption that in the frame of reference in which S sub f and T are at rest, the flow is superfast on both sides of T, and that a steady flow develops. As a result of the nonlinear analysis a flow pattern is obtained consisting of the incident discontinuities S sub f 1 and T2 and a transmitted fast shock S sub f 3, the modified tangential discontinuity T4 and a reflected fast shock S sub f 5 or fast rarefaction wave R sub f 5. The results are discussed in terms of seven significant similarity parameters. In addition special cases like changes in magnetic field direction only, changes in density or velocity shear only etc. are discussed. Author

N73-23755# Technische Hogeschool, Eindhoven (Netherlands). Dept. of Electrical Engineering.
TWO FLUID MODELS REEXAMINED FOR A COLLISIONLESS PLASMA IN THE STATIONARY STATE
F. Boeschoten Feb. 1972 31 p refs
(TH-72-E-28; ISBN-90-6144-028-9) Avail: NTIS HC $3.75

The mass rotation of the plasma is neglected and the role of the electric field is overestimated. Diamagnetic current carried equally by electrons and ions is described, so that for each species, the Lorentz force density is in equilibrium with the pressure. The plasma possesses a nonuniform mass rotation, and the electric field is important at the plasma boundary and at the plasma center. Author

N73-23756# Tokyo Univ. (Japan). Inst. of Space and Aeronautical Science.
CURRENT EXTENSION FROM A QUASI-STEADY MPD ARCJET
Kyoichi Kuriki and Masaaki Inutake Mar. 1973 17 p refs
(ISAS-490) Avail: NTIS HC $3.00

Experimental studies were made on the properties of a plasma stream emanating from a pulsed MPD arcjet. From diagnostic measurements, a large fraction of the discharge current was found to extend in the plasma downstream of the electrodes. This extending current was found to be desirable in the quasi-steady operation of an MPD arcjet. The quasi-steadiness should be inferred from the properties of the plasma flow as well as the current and voltage of the arc discharge. The current extension is strongly affected by the working gas injected before the arc discharge, initial tank pressure and applied magnetic field. An instability was found to be induced by the extending current in the plasma plume. Author

N73-23757# Technische Hogeschool, Eindhoven (Netherlands). Groep Direkte Omzetting.
CONDUCTING GRIDS TO STABILIZED MHD GENERATOR PLASMAS AGAINST IONIZATION INSTABILITIES
A. Veefkind Sep. 1972 21 p refs
(TH-72-E-31; ISBN-90-6144-031-9) Avail: NTIS HC $3.25

Ionization instabilities in MHD generators may be suppressed by the use of grids that short circuit the ac electric field component corresponding to the direction of maximum growth. An analysis of the influence of the corresponding boundary conditions has been performed in order to obtain more quantitive information about the stabilizing effect of this system. Author

N73-23758*# California Univ., Los Angeles. Plasma Physics Group.
FINITE BETA DRIFT ALFVEN INSTABILITY
Morrell S. Chance, Ferdinand V. Coroniti, and Charles F. Kennel Jan. 1973 30 p refs
(Grant NGR-05-007-190; Contract N00014-69-A-0200-4023)
(NASA-CR-131880; PPG-141) Avail: NTIS HC $3.50 CSCL 20I

A means by which the theory of drift instabilities can be extended to plasmas of arbitrary beta is proposed. Specialization is then made to the drift Alfven instability driven by an electron temperature gradient, considered to be a source of Pi-1 micropulsations on auroral lines of force. Even at relatively low beta, the full finite beta theory differs considerably from previous low beta theories, and produces better agreement with observation. Author

N73-23759# Naval Postgraduate School, Monterey, Calif.
AN INVESTIGATION OF THE SELF GENERATED MAGNETIC FIELDS ASSOCIATED WITH A LASER-PRODUCED PLASMA Ph.D. Thesis
Leslie Lawrence McKee, III Dec. 1972 176 p refs
(AD-757247) Avail: NTIS CSCL 20/9

A plasma was produced by irradiating a 5 mil thick Mylar ($C_{10}H_8O_4$) foil with a 300 MW, 25 nsec Nd laser pulse. Magnetic fields were observed to spontaneously arise when the laser-produced plasma was formed. The dependence of the self-generated magnetic fields on position, time, incident laser power, and ambient background pressure was investigated. The strength of the magnetic field, as well as its spatial and temporal dependences, was found to depend quite strongly on the background pressure of nitrogen. Most significantly, the strength

of the field increased by a factor of six when the pressure of the nitrogen background was increased from 1 m Torr to 200 m Torr. The results are analyzed by use of a theory in which the presence of a background gas influences the generating mechanism of the fields. Author (GRA)

N73-23760# Air Force Systems Command, Wright-Patterson AFB, Ohio. Foreign Technology Div.
THEORY OF PLASMA INSTABILITIES. VOLUME 1: INSTABILITIES OF HOMOGENEOUS PLASMA
A. B. Mikhailovskii 26 Oct. 1972 327 p refs Transl. into ENGLISH of the publ. "Teoriya Plazmennukh Neustoichivostei. Tom 1: Neustoichivosti Odnorodnoi Plazmy" Moscow, Atomizdat, 1970 p 1-294
(AD-755688; FTD-HC-23-735-72) Avail: NTIS CSCL 20/9

In the book on the theory of Plasma Instabilities, one of the most important sections of the theory of plasma is explained in a systematized manner. Detailed information concerning all basic types of plasma instabilities, beginning with beam instabilities and ending with plasma instabilities in a curved magnetic field, is given. The book consists of two volumes. In the first volume (Instabilities of Homogeneous Plasma), the author discusses instabilities caused by non-Maxwellian distribution of particles with respect to velocities, and in the second volume (Instabilities of Heterogeneous Plasma), he discusses the heterogeneity of the plasma and the magnetic field. Author (GRA)

N73-23761# Colorado State Univ., Fort Collins. Dept. of Physics.
INVESTIGATIONS ON THE DYNAMICS OF MHD FLOWS Annual Technical Report, 1 Jan. - 31 Dec. 1972
Horst E. Wilhelm 15 Jan. 1973 105 p refs
(Contract N00014-67-A-0299-0008; NR Proj. 099-389)
(AD-755944; ATR-4) Avail: NTIS CSCL 20/9

The report contains theoretical investigations on the steady state dynamics of compressible plasma flows across inhomogeneous magnetic fields in ducts with plane inclined walls (diffusers). By means of a similarity transformation, an exact analytical solution in terms of a hyperelliptic integral is derived for the fields of the polytropic flow of a compressible plasma across an azimuthal magnetic field. Mathematical theorems are proven which show the applicability of the similarity transformation to symmetric outflows (diffuser flows). A similarity transformation is presented which reduces the general partial differential equations for a plasma flow in a diffuser (with viscous momentum transfer, ohmic and viscous heating, and heat conduction) to ordinary nonlinear differential equations which are readily integrable by numerical methods. The associated boundary-value problem for the ordinary differential equations is formulated and discussed. Author (GRA)

N73-23762# Polytechnic Inst. of Brooklyn, N.Y.
RESEARCH OF AEROPHYSICS INSTITUTE FOR STRATEGIC TECHNOLOGY Semiannual Technical Summary, period ending 31 Aug. 1972
Martin H. Bloom Mar. 1972 25 p refs
(Contract DAHC04-69-C-0077; ARPA Order 1442)
(AD-757637; PIBAL-72-B; AROD-8677-33-P) Avail: NTIS CSCL 20/9

The report contains a description of the technical problem areas and accomplishments achieved during the reporting period. In addition, a complete list of publications, presentations, lectures, etc. is included and the personnel associated with the program are listed. The research projects are in the general subject areas of fluid and plasma dynamics. (Author Modified Abstract) GRA

N73-23763# Illinois Univ., Urbana. Dept. of Electrical Engineering.
AN EXPERIMENTAL STUDY OF THE FEASIBILITY OF INERTIALLY CONFINING ENERGETIC ELECTRONS AND IONS BY ELECTROSTATIC MEANS Final Report, 1 Jul. 1968 - 31 Dec. 1972
Joseph T. Verdeyen and Blake E. Cherrington Feb. 1973 55 p refs
(Grant AF-AFOSR-1584-68; AF Proj. 9752)
(AD-757228; UILU-ENG-73-2546; AFOSR-73-0438TR) Avail: NTIS CSCL 20/9

Experimental studies of the potential and the electron density inside inertial electrostatic plasma confinement devices have been performed using electron beam, microwave and laser diagnostic techniques. A distinctly oscillatory variation of the electron density as a function of radius was found in the cylindrical device for electron and ion injection into a low pressure deuterium gas background. Electron injection into a hard vacuum was found to produce a deep potential well in the spherical device whereas electron injection into a low pressure gas was found to create steady state alternating potential wells. Author (GRA)

N73-23764# Air Force Cambridge Research Labs., L. G. Hanscom Field, Mass.
NONLINEAR THEORY OF ELECTRON OSCILLATIONS OF A COLLISIONLESS PLASMA IN A UNIFORM MAGNETIC FIELD Physical Sciences Research Papers
H. K. Sen, B. Prasad, P. M. Bakshi, and G. Kalman 5 Sep. 1972 51 p refs
(AF Proj. 8608)
(AD-756477; AFCRL-72-0526; AFCRL-PSRP-509) Avail: NTIS CSCL 20/9

Possibility of excitation of finite amplitude longitudinal waves in a collisionless and cold plasma in the presence of a uniform magnetic field is demonstrated. Such waves are found to be anharmonic in shape, in contrast to the usual harmonic, that is, sinusoidal waves of the linear theory. These nonlinear plasma waves arise as a result of nonlinear motion and the dispersive nature of plasma media. The two competing processes, nonlinearity and dispersion in a moving plasma medium strike a balance to produce a quasi-steady state which can support finite amplitude waves. These waves are associated with large amplitude oscillating electric fields which may be responsible for coherent radio-to-microwave radiation from coronal plasma and particle acceleration during solar flares. The estimate of sporadic electromagnetic and particulate radiation is important for application to the solar flare patrol and the Air Force Communications System. Author (GRA)

N73-23765# Avco-Everett Research Lab., Everett, Mass.
EXPERIMENTAL AND ANALYTICAL RESEARCH ON A TWO MEGAWATT, HIGH PERFORMANCE MHD GENERATOR Interim Report, 1 Apr. 1971 - 1 Oct. 1972
O. K. Sonju and J. Teno Oct. 1972 341 p refs
(Contract F33615-71-C-1456; AF Proj. 3145)
(AD-756489; AFAPL-TR-72-98) Avail: NTIS CSCL 10/2

The report presents the initial results of a combined analytical and experimental program whose broad objectives are to achieve a more complete understanding of the operation and appropriate design techniques of compact high-performance MHD generators by further establishing the detailed analytical basis of the performance of these generators and to demonstrate the feasibility of operating compact high-performance MHD generators under a repetitively pulsed mode of operation at high power levels in this case at the 2 MW level. In particular, the results of studies of stability, and effects, transient response, diagnostic, rapid startup, channel voltage breakdown and performance optimization are discussed and summarized. A parallel effort under this program has been directed to constructing a generator test facility and designing and fabricating a 2 MW high-performance MHD generator system to be used in the test facility. Author (GRA)

N73-23766# Air Force Weapons Lab., Kirtland AFB, N.Mex.
COMPUTER SIMULATION OF THE SATURATION OF THE PARAMETRIC INSTABILITY IN THE WEAK TURBULENCE REGION Technical Report, Jan. - Oct. 1972
Brendan B. Godfrey, Clifford E. Rhodes, Jr., and Keith A. Taggart Feb. 1973 40 p refs
(AF Proj. 8809)
(AD-757265; AFWL-TR-72-228) Avail: NTIS CSCL 20/9

The theory of nonlinear saturation of the parametric decay instability in the weak turbulence limit is developed, and the resulting kinetic equation solved numerically for a variety of cases. These solutions are compared with the results of a series of computer simulations. Agreement is found to be good only for pump powers below threshold, with the reason for partial failure above threshold unclear. The validity of the random phase approximation is discussed also. A summary of computational methods is provided. Author (GRA)

N73-23767# Naval Research Lab., Washington, D.C. Plasma Applications Branch.
THE CORONAL EQUILIBRIUM OF HIGH ATOMIC NUMBER PLASMAS Final Report
David Mosher Mar. 1973 29 p refs
(NRL Proj. H02-26A; DNA Proj. NWER-LA-01303)
(AD-758357; NRL-MR-2563) Avail: NTIS CSCL 20/9

The distribution of ionization states in carbon, aluminum, copper, and tungsten plasmas is determined from the Corona model equilibrium. The variation of mean ionization level, internal energy, and radiation rates with temperature are then determined by averaging over the ionization states. Results are presented in a form which allow the reader to easily use them with plasma fluid equations in order to describe the dynamics of an radiation from high atomic plasmas. Author (GRA)

N73-23768# California Univ., Los Angeles. School of Engineering and Applied Science.
DIRECTIONAL TRANSPORT EQUATIONS FOR PLASMAS
P. K. C. Wang Feb. 1973 19 p refs
(Grant AF-AFOSR-2302-72; AF Proj. 9752)
(AD-758275; UCLA-ENG-7325; AFOSR-73-0515TR) Avail: NTIS CSCL 20/9

The equations governing the directional transport of plasmas are derived from the Boltzmann's equation by averaging over a given subset of the velocity space. Their application to plasma confinement by means of external time-dependent electromagnetic fields is discussed. Author (GRA)

N73-23769# Illinois Univ., Urbana. Coordinated Science Lab.
A NOTE ON WAVE-WAVE COUPLING IN NONRESONANT UNSTABLE SYSTEMS
E. Atlee Joackson and M. Raether Jan. 1973 14 p refs
(Contracts DAAB07-67-C-0199; DAAB07-72-C-0259)
(AD-758316; R-598; UILU-ENG-72-2263) Avail: NTIS CSCL 20/9

The power series expansion of the dielectric function that is employed in deriving the equations for wave-wave coupling often diverges if the wave-particle interactions are non-resonant. This difficulty can be eliminated by expanding in terms of the complex eigen modes of the linear system. These ideas are illustrated for a cold beam - cold plasma system. Author (GRA)

26 PHYSICS, SOLID-STATE

Includes semiconductor theory; and superconductivity. For applications see: 16 Masers. For related information see also: 10 Electronics.

N73-23770*# National Aeronautics and Space Administration. Marshall Space Flight Center, Huntsville, Ala.
SYSTEM FOR DEPOSITING THIN FILMS Patent Application
Philip W. Tashbar, inventor (to NASA) Filed 2 May 1973 14 p
(NASA-Case-MFS-20775-1; US-Patent-Appl-SN-356664) Avail: NTIS HC $3.00 CSCL 20L

A method is described for the deposition of a thin film of a vaporized material on another material. A source of vaporized deposition material is ionized, focused into a beam, passed through a mass filter which extracts impurities, and directed onto a substrate material in a vacuum chamber. F.O.S.

N73-23771# University of Southern Calif., Los Angeles. Electronic Sciences Lab.
[RESEARCH PROGRESS ON SEMICONDUCTOR AND SOLID STATE DEVICES] Consolidated Semiannual Progress Report, 1 Apr. - 30 Sep. 1972
Z. A. Kaprielian 30 Sep. 1972 78 p
(Contract F44620-71-C-0067; AF Proj. 4751)
(AD-757521; AFOSR-73-0502TR; SAPR-16) Avail: NTIS CSCL 20/12

Contents: Materials and semiconductors; Quantum electronics; Magnetism; Metals; alloys and low temperature physics; Solid state devices; Defect chemistry and solid state electrochemistry; Plasmas and applied electromagnetics; Control systems; Communication systems; Computer systems and automata theory; Electric power systems; Mathematical biosciences and biomedical engineering. GRA

N73-23772# Chemical Lab. RVO-TNO, Rijswijk (Netherlands).
THE EFFECT OF GASES ON THE CONDUCTIVE PROPERTIES OF ORGANIC SEMICONDUCTORS. 4: MEASUREMENTS AND RESULTS FOR THE SUBLIMED FILMS OF PHENOTHIAZINE, PHTALOCYANINE (METAL FREE), VIOLANTHRONE AND THIONINE
M. VandenBrink and D. VanLeeuwen Aug. 1972 42 p refs
(Rept-1972-19) Avail: NTIS HC $4.25

Strong electron-donating or strong electron-accepting gases (respectively dimethylamine and ammonia, and nitrogen dioxide and chlorine) have great influence on the conductivity of the four studied organic semiconductors: phenothiazine, phtalocyaenine (metal-free), violanthrone and thionine. At very low pressures (in some cases at 0.003 Torr) a deviation of 50 percent in the dark current is measured. Other vapors such as sulfur dioxide, oxygen and water result in a less strong deviation of the dark conductivity. Memory effects for gases and for light are present at all cases. Slight peaks (shoulders) are present in the photoresponse curves of phtalocyanine (metal-free) caused by a gas-semiconductor charge transfer. During gas adsorption the activation energy changes are irreversible. The selectivity is not high, and identification can be carried out only by deduction. Many semiconductor systems can be measured at the same time. Author

N73-23773# Stanford Univ., Calif. Dept. of Applied Physics.
THE BOND ORBITAL MODEL AND THE PROPERTIES, OF TETRAHEDRALLY COORDINATED SOLIDS
Walter A. Harrison 18 Apr. 1973 40 p refs Submitted for publication
(Grant NSFGP-25945)
Avail: NTIS HC $4.00

A model electronic structure is explored which attempts to relate a wide range of properties to a few parameters of covalent and polar solids. The model is based upon tight binding combinations of bonding hybrid orbitals. The matrix elements associated with metallicity are obtained directly from the atomic terms values; those associated with covalency and polarity are obtained from the static dielectric constant using essentially the approach of Phillips, but in terms of the formula for the dielectric constant appropriate to this model. Other properties calculated include the valence energy bands themselves, obtained explicitly for silicon and for gallium arsenide. In treating other properties the unitarity of the final diagonalization was utilized to avoid carrying it out explicitly. The dipole moment of the individual bonds was defined and calculated as was an effective ionic charge. The cohesive energy was also obtained for ionic and metallic structures as well as for the covalent tetrahedral structures. Criteria for the stability of each structure were obtained. The model also explains why some properties scale approximately linearly with ionicity as defined by Phillips. Author

N73-23774*# National Aeronautics and Space Administration. Lewis Research Center, Cleveland, Ohio.
THEORY OF DISORDERED HEISENBERG FERROMAGNETS
Robert M. Stubbs Washington May 1973 90 p refs
(NASA-TN-D-7208; E-6936) Avail: NTIS HC $3.00 CSCL 20C

A Green's function technique is used to calculate the magnetic properties of Heisenberg ferromagnets in which the exchange interactions deviate randomly in strength from the mean interaction. Systems of sc, bcc, and fcc topologies and of general spin values are treated. Disorder produces marked effects in the density of spin wave states, in the form of enhancement of the low-energy density and extension of the energy band to higher values. The spontaneous magnetization and the Curie temperature decrease with increasing disorder. The effects of disorder are shown to be more pronounced in the ferromagnetic than in the paramagnetic phase. Author

N73-23775*# Cleveland State Univ., Ohio.
[FUNDAMENTAL PROPERTIES OF SEMICONDUCTOR MATERIALS, AND MATERIAL PERFORMANCE IN DETECTORS] Final Technical Report
Karl J. Casper 6 Feb. 1973 11 p refs

(Grant NGL-36-025-001)
(NASA-CR-121187) Avail: NTIS HC $3.00 CSCL 20L

Procedures for determining fundamental properties of semiconductor materials, their performance as radiation detectors, and their service life as such detectors are given. Relationships were established between the minority carrier lifetime in the bulk of the material and the charge collection efficiency of the detector. E.H.W.

N73-23776# Oregon Graduate Center for Study and Research, Beaverton. Dept. of Applied Physics.
STUDIES ON Al BASE RARE EARTH ALLOYS WITH POTENTIAL FOR OUTSTANDING PERMANENT MAGNET PROPERTIES Annual Report, 1 Mar. 1972 - 1 Mar. 1973
Hans Oesterreicher 1 Mar. 1973 160 p refs
(Contract N00014-68-A-0461-0002)
(AD-756245) Avail: NTIS CSCL 20/12

Data pertaining to structures, phase relations, and magnetic properties over a wide region in temperature are presented for Al substituted rare earth (R) transition metal (T) alloys of composition R2T17, RT5 and RT2. The mode of this substitution is investigated by X-ray diffraction. Large increases of coercive force are observed on Al substitution, particularly at low temperatures. The temperature dependence of coercive force is investigated. Changes in direction of easy magnetization are described as a function of concentration and temperature in Al substituted PrCo5. The mechanism of magnetization in narrow domain wall rare earth Laves phases is investigated.
Author (GRA)

N73-23777# University of Southern Calif., Los Angeles. Electronic Sciences Lab.
NEW METHODS FOR GROWTH AND CHARACTERIZATION OF GaAs AND MIXED III-V SEMICONDUCTOR CRYSTALS Semiannual Technical Report, 1 Jul. - 31 Dec. 1972
William R. Wilcox, Clarence R. Crowell, Agerico L. Esquivel, Eric L. Johnson, and Pat Leung 31 Dec. 1972 114 p refs
(Contract DAHC15-72-G7; ARPA Order 1628)
(AD-756259; USCEE-437) Avail: NTIS CSCL 20/12

The purpose of this program is to develop new and improved methods for the growth and characterization of gallium arsenide (GaAs) and mixed III-V semiconductor crystals. Ten floating zone passes were completed on 1 cm diameter GaAs using a new liquid encapsulation technique. Optimal conditions for growth of 1 cm diam GaAs were determined by the travelling heater method. Ga(x)In(1-x)Sb and Ga(x)Al(1-x)As were also prepared. Studies were also made on a new Czochralski technique permitting growth of dislocation-free GaAs, on the gradient freeze growth technique, on nucleation of gas bubbles during crystallization, on oxygen measurement and pumping by electrochemical methods, on cathodoluminescence and electrical anisotrophy due to introduction of dislocations, on Si in GaAs, on the influence of light on cathodoluminescence, and on GaAs Schottky barriers. (Author Modified Abstract) GRA

N73-23778# Air Force Systems Command, Wright-Patterson AFB, Ohio. Foreign Technology Div.
RADIATION EFFECTS IN SEMICONDUCTORS AND IN SEMICONDUCTOR INSTRUMENTS, PART 2
V. S. Vavilov and N. A. Ukhinn 19 Jan. 1973 199 p refs
Transl. into ENGLISH from the publ. "Radiatsionnye Effedkty v Poluprovodnikakh i Poluprovodnikovykh Priborakh" Moscow, Atomizdat, 1969 p 131-311
(AD-755690; FTD-MT-24-1441-72-Pt-2) Avail: NTIS CSCL 09/1

The book presents parameter changes caused by experimental irradiation of transistors, a criterion of transistor radiation resistance, and effects on transistors of various types and levels of irradiation. Changes in parameters and characteristics of semiconductor diodes including V/A characteristics and conductivity, are examined, as is the effect of pulsed irradiation on semiconductor devices. Author (GRA)

N73-23779# Lincoln Lab., Mass. Inst. of Tech., Lexington.
SOLID STATE RESEARCH, 1972, 4 Quarterly Technical Summary Report, 1 Aug. - 31 Oct. 1972
Alan L. McWhorter 15 Nov. 1972 68 p refs
(Contract F19628-73-C-0002; AF Proj. 649L)
(AD-757559; ESD-TR-72-259) Avail: NTIS CSCL 20/12

The report covers in detail the solid state research work of the Solid State Division at Lincoln Laboratory for the period 1 August through 31 October 1972. The topics covered are Solid State Device Research, Quantum Electronics, Materials Research, Physics of Solids and Microelectronics. The Microsound work is sponsored by ABMDA and is reported under this program.
Author (GRA)

N73-23780# California Univ., Riverside. Dept. of Physics.
ON THE INTERPRETATION OF AC CONDUCTIVITY IN AMORPHOUS SEMICONDUCTORS
M. Pollak Feb. 1973 49 p refs
(Contract N00014-69-A-0200-5005)
(AD-757097) Avail: NTIS CSCL 20/12

An extensive survey of the experimental literature on ac conductivity and on the dielectric dispersion in glasses is reported. Research is focused on the region where sigma = A(omega to the s power), s approximately equal to 1. The various materials seem to fall into two groups. The characteristic features of the one are a relative insensitivity of both A and s to temperature, with s approximately equal to 0.8. In the second group A increases as a high power of T, while s varies from about 1 at low temperatures to about 0.8 at high temperatures. A variety of possible models is examined in some detail. It is found that the behavior of the first group is well explained by phonon assisted hopping, while the other group can be explained either by hopping over a barrier, or by phonon assisted hopping with a subsequent lattice relaxation (e.g. polaron hopping).
Author (GRA)

N73-23781# Naval Ordnance Lab., White Oak, Md.
THE SINGLE CRYSTAL LINEAR SUSCEPTIBILITIES OF FeF2 FOR THE SPONTANEOUS AND PARAMAGNETIC REGIMES
Louis F. Libelo and Francis J. Petrone 8 Dec. 1972 54 p refs
(AD-757009; NOLTR-72-283) Avail: NTIS CSCL 20/12

Using the self-consistent cluster-variation method, the static longitudinal and transverse susceptibilities were calculated for FeF2 as a function of temperature. In the spontaneous magnetization range spontaneous local fields were utilized as inputs for this calculation. These local field values yield spontaneous sublattice magnetization values in agreement with experimental data over a temperature range that considerably exceeds the spin-wave and D = 9.4K. The longitudinal susceptibility was found to converge rapidly so that higher order perturbation calculations result in negligible improvement at all temperatures. The transverse susceptibility, on the other hand, is shown to improve more markedly as the perturbation calculation is extended to higher order. Author (GRA)

N73-23782# Brandeis Univ., Waltham, Mass. Dept. of Physics.
EXPERIMENTAL STUDIES OF PHASE TRANSITIONS Final Summary Report
Peter Heller and William S. Gornall Mar. 1973 10 p ref
(Grant AF-AFOSR-2247-72; AF Proj. 9764)
(AD-757223; AFOSR-73-0094TR) Avail: NTIS CSCL 20/12

Phase transitions have been investigated using neutron scattering, computer simulation and magnetic resonance techniques. Particular attention has been given to dynamical properties. This includes a study of the coupling of the energy density and order parameter fluctuations in antiferromagnets. The time average behavior in the spin-flopped state has also been studied. In addition Raman scattering spectroscopy has been used to initiate a study of noble gases at temperatures near the condensation point. Author (GRA)

N73-23783# Pennsylvania State Univ., University Park. Dept. of Physics.
TRANSPORT OF ELECTRONS AND HOLES IN SEMICONDUCTORS Final Report
John P. McKelvey 1 Mar. 1973 12 p refs
(Grant AF-AFOSR-1773-69; AF Proj. 9763)
(AD-757232; AFOSR-73-0463TR) Avail: NTIS CSCL 20/12

Work related to the investigation of excess carrier lifetime as a function of hydrostatic pressure in germanium, to the investigation of high-stress piezodrift effects in p-type germanium, and to the investigation of high-stress piezoresistance of p-type

germanium has been completed and published. Studies involving transport behavior of charge carriers in silicon and gallium phosphide are being continued. Apparatus has been constructed to perform the required transport measurements down to 4 degrees K under high uniaxial stress. Work directed toward the construction of the phonon spectrum of lead iodide crystals is being continued. Coupling on consultation activities are briefly described. A list of degrees awarded and articles published under the sponsorship of the grant is included. (Author Modified Abstract) GRA

N73-23784# Stanford Univ., Calif. Microwave Lab.
MICROWAVE ACOUSTIC AND BULK DEVICE TECHNIQUES STUDIES Interim Technical Report, 1 May - 31 Oct. 1972
Marvin Chodorow and H. J. Shaw Jan. 1973 38 p refs
(Contract F30602-71-C-0125)
(AD-757555; ML-2108; RADC-TR-73-3; ITR-5) Avail: NTIS CSCL 20/12

The objectives of the contract are to advance new theory and device techniques for the generation and processing of microwave signals using elastic, electro-magnetic, and carrier space charge waves in solid media. The work is divided into three projects, as follows: bulk and surface acoustic wave amplifiers, acoustic parametric interactions, wide bandwidth dispersive delay lines. Significant results include broadband efficient excitation in an amplifier with net gain; a new convolution device with 30 db greater interaction strength than with lithium niobate; and a bulk wave device for convolution/correlation, time reversal, and fast Fourier transform of arbitrary signals. Work on wide bandwidth dispersive delay lines has led to the achievement of lines with near octave bandwidth, centered at 200 MHz, and linear dispersion characteristics. Author (GRA)

N73-23785# California Univ., Berkeley. Dept. of Physics.
COMMENTS ON DC CONDUCTIVITY IN AMORPHOUS 1972, SEMICONDUCTORS
M. Pollak 1972 11 p refs
(Contract N00014-69-A-0200-5005)
(AD-756783) Avail: NTIS CSCL 20/12

A recent paper in this Journal is discussed in which the authors argue that Mott's T to the minus 1/4 power law should be corrected to a T to the minus 1/3 power law. Arguments are presented here against the latter, and it is shown that Mott's version is correct. Author (GRA)

N73-23786# Wyoming Univ., Laramie. Dept. of Physics and Astronomy.
A STUDY OF ELECTRONIC STATES AND TRANSPORT IN AMORPHOUS SEMICONDUCTORS Final Report, 2 Jun. 1970 - 31 May 1972
Shinzo Nakai 31 May 1972 11 p refs
(Contract N00014-70-A-0266-0001; NR Proj. 017-650)
(AD-757432) Avail: NTIS CSCL 20/12

The author investigated impurity conduction in doped semiconductors using the Green's function method for high impurity concentrations at temperatures near zero. GRA

N73-23787# Pennsylvania Univ., Philadelphia. Dept. of Physics.
[MAGNETIC SEMICONDUCTORS AND MAGNETIC ASPECTS OF THE MOTT TRANSITION] Final Report
Herbert Callen 30 Jul. 1972 12 p refs
(Contract N00014-67-A-0216-0011)
(AD-757435) Avail: NTIS CSCL 20/12

The initial focus of the project was magnetic semiconductors and the magnetic aspects of the Mott transition. In the last year of the project a considerable amount of work was done on magnetic bubble materials. Also liquid crystals have been investigated, and a variety of problems in impurity states in magnetic materials, and in the general theory of magnetic interactions. GRA

N73-23788# Naval Postgraduate School, Monterey, Calif.
THE GROWTH OF IRON WHISKERS BY THE HIGH TEMPERATURE REDUCTION OF FERROUS HALIDE SALTS M.S. Thesis
Charles William Jaget Dec. 1972 82 p refs
(AD-757588) Avail: NTIS CSCL 20/2

The growth mechanism of iron whiskers produced by the hydrogen reduction of iron halide salts was investigated by the variation of a number of parameters. The observations are correlated with current theories and with the thermodynamic behavior of this reaction which indicates that the tip of the growing whisker should be colder than the ambient medium (the cold tip). The mass growth of iron whiskers in the presence of carbon was examined to evaluate the potential of this method to produce marketable whiskers. An unidentified, nonmetallic whisker growth was discovered growing in bone charcoal. Growth was determined to require the presence of a ferrous halide and calcium orthophosphate. Further postulates concerning the cool tip theory are made. Author (GRA)

N73-23789# Kent State Univ., Ohio. Liquid Crystal Inst.
INTERNATIONAL LIQUID CRYSTAL CONFERENCE (4TH) Final Scientific Report
Glenn H. Brown Feb. 1973 107 p refs Conf. held at Kent, Ohio, 21-25 Aug. 1972
(Grant AF-AFOSR-2251-72; AF Proj. 9536)
(AD-757224; AFOSR-73-0436TR) Avail: NTIS CSCL 07/4

The report contains a brief review of the Fourth International Liquid Crystal Conference held at Kent State University. One hundred and eighty-one papers were on the program and approximately 380 people registered from 16 countries. There were ten plenary lectures. Highlights of the conference are noted as covering reviews of the history of liquid crystals, thermodynamics and flow properties of liquid crystals, electrical effects, crystals, magnetic resonance studies of thermotropic liquid crystals, lyotropic properties, symmetries and polymorphism in the smectic state, liquid crystalline aspects of biological membrane structure, recent advances in preparation of liquid crystals, disinclinations in nematics and cholestrics and properties of the director-vector field, and the problems of polymorphism in liquid crystals. (Author Modified Abstract) GRA

N73-23790# Vanderbilt Univ., Nashville, Tenn. School of Engineering.
STRUCTURAL EFFECTS ON ELECTRICAL PROPERTIES IN AMORPHOUS SEMICONDUCTORS Semiannual Technical Report, 1 Jul. - 31 Dec. 1972
D. L. Kinser and L. K. Wilson 31 Jan. 1973 124 p refs
(Contract DAHC04-70-C-0046; ARPA Order 1562)
(AD-758373; SATR-5) Avail: NTIS CSCL 20/12

A survey was made of the structure, electrical and magnetic properties of transition metal oxide phosphate glasses and glasses of the As2Te3-As2Se3 system. Results of magnetic and electrical observations in several transition metal phosphate glasses have revealed a high degree of magnetic and structural order. Examination of a representative group of transition metal phosphate glasses in a Cobalt 60 radiation source has revealed a pronounced effect upon the dc conductivity of these glasses. Detailed studies of the conduction process in copper phosphate glasses have revealed a mixed conduction mechanism of ionic and electronic mechanisms. This mixed conduction changes to exclusively electronic with thermal treatments which slightly densify the glass. (Author Modified Abstract) GRA

N73-23791# Virginia Polytechnic Inst. and State Univ., Blacksburg.
NONCRYSTALLINE SEMICONDUCTORS: ELECTRICAL AND THERMAL PROCESSES Annual Technical Report
Lyle H. Slack 28 Feb. 1973 44 p refs
(Grant DA-ARO(D)-31-124-72-G72; ARPA Order 1562)
(AD-758133) Avail: NTIS CSCL 20/12

The purpose of this research project is to characterize the switching process in selected amorphous semiconductors. The research has been divided into two parts, the first comparing the actual switching behavior of amorphous semiconductor films with computer simulations of switching based on an assumed thermal model. The second part of the research compares the electron energy spectrum of crystalline and amorphous semiconductors of the same composition in order to understand the uniqueness of amorphous semiconductor's electrical properties. GRA

N73-23792# Army Foreign Science and Technology Center, Charlottesville, Va.
EFFECTS OF NEUTRON IRRADIATION ON THE ELECTRI-

CAL PROPERTIES OF INDIUM ARSENIDE
B. I. Boltake and E. P. Savin 12 Jan. 1973 11 p refs Transl. into ENGLISH from Radiats. Fiz. (Riga) p 116-123
(AD-757468; FSTC-HT-23-1435-72) Avail: NTIS CSCL 20/12

The article discussed the results of research into radiation defects, arising in neutron irradiation of n- and p-type indium arsenide, and their effect on the electrical properties of crystals, as well as the results of studies of the kinetics of annealing these defects. (Author Modified Abstract) GRA

N73-23793# Manlabs, Inc., Cambridge, Mass.
PHYSICAL CHARACTERIZATION OF ELECTRONIC MATERIALS, DEVICES AND THIN FILMS Final Report, 1 Dec. 1969 - 30 Nov. 1972
S. Andrew Kulin and Konstantin Kreder 1 Dec. 1972 27 p
(Contract F19628-70-C-0140; AF Proj. 5620)
(AD-758197; AFCRL-TR-73-0070) Avail: NTIS CSCL 20/2

The research is directed toward the characterization of specified physical, chemical and structural properties of various materials. Experimental methods include chemical analysis, electron microscopy and reflection diffraction, X-ray diffraction and fluorescence analysis, light microscopy and electron microprobe analysis, in addition to the determination of specific properties, such as density, hardness and thermal conductivity. Special services, such as crystal orientation, cutting, grinding and polishing are also being performed. Specific materials submitted for characterization include lithium germanate, silicon, silicon carbide, quartz, ruby, gallium arsenide, boron, lithium niobate, lithium tantalate, lithium fluoride, potassium chloride, sodium chloride, potassium bromide, gallium phosphide, indium phosphide, calcium fluoride, zinc telluride, bismuth germanium oxide and aluminum nitride. In addition, a variety of specimens have been submitted for specific studies such as phase identification, crystallinity and chemical analysis. Author (GRA)

N73-23794# Manitoba Univ., Winnipeg. Dept. of Physics.
AN INVESTIGATION OF THE ac SUSCEPTIBILITY OF SOME RCo5 COMPOUNDS Final Report, 1 Feb. - 31 Jul. 1972
I. Maartense and C. W. Searle Wright-Patterson AFB, Ohio AFML Nov. 1972 31 p refs
(Contract F33615-72-C-1471; AF Proj. 7367)
(AD-758218; AFML-TR-72-334) Avail: NTIS CSCL 20/12

The ac susceptibilities of powdered samples of SmCo5, YCo5, and NdCo5 have been measured at frequencies between 1.5 and 75 kHz and at temperatures between 4.2 and 300K. No definite frequency dependence was noted. Except near the spin reorientation temperatures of NdCo5 and PrCr5, the susceptibility is very low, indicating extensive pinning of domain walls. Near 150K, NdCo5 shows an unusual dependence on the cooling rate. Field sweeps of the order of plus or minus 100 Oe show time and field dependences including disaccommodation, a sweep rate dependence and a field turnaround anomaly. These observations are discussed on the basis of a tentative model of domain wall pinning. Author (GRA)

N73-23795# Office of Naval Research, London (England).
PHYSICS RESEARCH - SPANISH STYLE (1972)
Edgar A. Edelsack 5 Mar. 1973 13 p refs
(AD-757991; ONRL-R-4-73) Avail: NTIS CSCL 20/12

Solid state and low temperature physics research at the following three Spanish universities are reported: University of Granada, University of Madrid, and the Autonomous University of Madrid. A brief reivew of the Spanish education system is included. Author (GRA)

N73-23976* Jet Propulsion Lab., Calif. Inst. of Tech., Pasadena.
DEVELOPMENT OF A THICK FILM SILICON RIBBON GROWTH TECHNIQUE FOR APPLICATION TO LARGE-AREA SOLAR CELLS AND ARRAYS
P. A. Berman *In its* Quart. Tech. Rev., Vol. 2, No. 4 Jan. 1973 p 44-52 refs (For availability see N73-23970 14-34) CSCL 20L

27 PROPELLANTS

Includes fuels; igniters; and oxidizers. For basic research see: 06 Chemistry; and 33 Thermodynamics and Combustion. For related information see also: 28 Propulsion Systems.

N73-23796# Lockheed Missiles and Space Co., Palo Alto, Calif.
COMBUSTION OF A BALLISTIC H POWDER IN AN ACOUSTIC STREAM
V. N. Viliunov, A. A. Duoriashin, A. D. Margonlin, S. K. Ordzhonikidze, and P. F. Pokhill [1972] 5 p refs Transl. into ENGLISH from Fiz. Goreniya Vzryva (Novosibirsk), v. 8, no. 4, 1972 p 501-505
Avail: NTIS HC $3.00; National Translations Center, John Crerar Library, Chicago, Illinois 60616

Erosion combustion of ballistic H powder in an acoustic stream is investigated using two methods: the computational and direct. A conical supersonic nozzle was used for the study with combustion products from the powder providing the blowing stream. Results show both methods are in agreement. E.H.W.

N73-23797# Bell Aerospace Co., Buffalo, N.Y.
PROPELLANT IMPROVEMENT PROGRAM. VOLUME 2: IRON CONTAMINATION EFFECT IN HDA (HIGH DENSITY ACID) Special Technical Report, 1 Mar. - 31 Oct. 1972
A. H. Blessing and H. Joseph Loftus Jan. 1973 63 p refs
(Contract F04611-72-C-0026; AF Proj. 3058)
(AD-755376; Rept-8643-928002-Vol-2; AFRPL-TR-73-7-Vol-2)
Avail: NTIS CSCL 21/9

The report concerns research on improving the liquid propellant system of unsymmetrical dimethyl hydrazine and fuming nitric acid (also designated as High Density Acid). The studied and presented objectives are the forced convection heat transfer characteristics of Standard and Modified high Density Acid (HDA) and the effect of iron impurity level up to 100 parts per million as Fe2O3 on HDA heat transfer. Thirty tests were conducted using resistance heated, circular, 6061T6 aluminum tubes. Results showed that normal nucleate boiling did not occur with either of the HDA compositions. The experimental forced convection heat transfer coefficients were unaffected by iron impurity level and exhibited increased values with increased bulk temperature. Author (GRA)

N73-23798# Bell Aerospace Co., Buffalo, N.Y.
PROPELLANT IMPROVEMENTS PROGRAM. VOLUME 3: ADDITIVES FOR HEAT FLUX REDUCTION Special Technical Report, 22 Nov. 1971 - 21 Jul. 1972
H. Joseph Loftus, L. D. Nasiak, and C. M. Schmidt Sep. 1972 129 p refs
(Contract F04611-72-C-0026; AF Proj. 3058)
(AD-756913; Rept-8643-928003-Vol-3;
AFRPL-TR-72-78-Vol-3) Avail: NTIS CSCL 21/9

The objectives of the task were: to establish the best silicone additive for use with each of three hydrazine type fuels (UDMH, MMH and 50/50) based on solubility and stability tests; to determine physical properties and heat transfer characteristics of the fuel blends; and to establish engine performance and heat flux reduction effects by conducting fire tests with the 50/50 fuel blend and N2O4 oxidizer. Solubility screening tests of 132 compounds showed that UDMH was the best solvent for silicones, with MMH intermediate, and then 50/50 fuel. Fuel blends containing 3 percent concentration by weight of silicone were subjected to 48 hour temperature stability tests and 30 day storage tests. The best additive for each fuel was selected and vapor pressure and density determinations were made. (Author Modified Abstract) GRA

N73-23799# Frost (Edward R.) and Associates, Newport Beach, Calif.
DESIGN OF MICROFILM ACQUISITION, STORAGE AND RETRIEVAL SYSTEM FOR SOLID PROPELLANT MECHANICAL BEHAVIOR DATA Final Report, 15 Feb. - 10 Apr. 1972
Edward R. Frost 10 Apr. 1972 59 p
(Contract F04611-72-C-0016)
(AD-757245; AFRPL-TR-72-40) Avail: NTIS CSCL 21/9

The report contains the results of a microfilm system design and update which have as their primary objective the establishment of a standardized microfilm system for acquisition, storage and retrieval of raw physical properties data generated during solid propellant research and development programs. The proposed system was designed to be economical, convenient and non-burdensome with a simplified automated tabulating system to facilitate data handling. Some factors taken into consideration before arriving at the final design were state-of-the-art, availability of equipment, availability of service bureaus, indexing requirements, incidence of retrieval, physical characteristics of raw data formats, techniques for comparative analysis, data exchange requirements, and interrelated data requirements. (Author Modified Abstract) GRA

N73-23800# Stevens Inst. of Tech., Hoboken, N.J. Dept. of Mechanical Engineering.
EXPERIMENTAL STUDY OF THE COMPOSITE SOLID PROPELLANT DEFLAGRATION PROCESS ON A FUNDAMENTAL LEVEL Final Report, 1 Oct. 1961 - 15 Nov. 1972
Robert F. McAlevy, III and Richard B. Cole Feb. 1973 10 p refs
(Contract N00014-67-A-0202-0023)
(AD-757066; ME-RT-72008) Avail: NTIS CSCL 21/9

Investigations over an eleven-year period of the overall mechanism of composite solid propellant deflagration and its component processes are summarized. Experimental studies and techniques involving diagnostic measurements on analog burners (of several types) and characterizations of the linear pyrolysis of propellant ingredients (polymers and ammonium perchlorate) are included along with efforts at modeling the overall mechanism. All publications resulting from the work reported are cited. Author (GRA)

28 PROPULSION SYSTEMS

Includes air breathing, electric, liquid, solid, and magneto-hydrodynamic propulsion. For nuclear propulsion see: 22 Nuclear Engineering. For basic research see: 23 Physics, General; and 33 Thermodynamics and Combustion. For applications see: 31 Space Vehicles. For related information see also: 27 Propellants.

N73-23801# Lockheed Missiles and Space Co., Palo Alto, Calif.
SOME RESULTS OF FLIGHT TESTS OF AN ION ENGINE MODEL WITH SURFACE IONIZATION OF CESIUM ON TUNGSTEN
F. V. Gavrilov, A. S. Miasnikov, G. G. Zhadan, G. S. Orlova, and M. V. Strokin [1973] 6 p refs Transl. into ENGLISH from Kosmich. Issled. (Moscow), v. 11, no. 1, 1973 p 140-144
Avail: NTIS HC $3.00; National Translations Center, John Crerar Library, Chicago, Ill. 60616

An automatic ionospheric spaceflight laboratory with an ion engine model using surface ionization of cesium on tungsten was launched in November 1969 and August 1970 using a geophysical rocket. The main goal of the launching was to investigate the operation of diverse systems of this engine under almost natural conditions. Some results of the investigation concerning the efficiency of the ion jet neutralization are presented. Author

N73-23802*# National Aeronautics and Space Administration. Langley Research Center, Langley Station, Va.
EFFECT OF FINENESS RATIO ON BOATTAIL DRAG OF CIRCULAR-ARC AFTERBODIES HAVING CLOSURE RATIOS OF 0.50 WITH JET EXHAUST AT MACH NUMBERS UP TO 1.30
David E. Reubush and Jack F. Runckel Washington May 1973 94 p refs
(NASA-TN-D-7192; L-8705) Avail: NTIS HC $3.00 CSCL 01A

An investigation was conducted to determine the effect of fineness ratio on the drag of circular-arc boattails at subsonic and low supersonic speeds. The boattails had closure ratios of 0.50 and incorporated convergent nozzles. The investigation was conducted statically and at Mach numbers from 0.40 to 1.30 at 0 deg angle of attack with jet total-pressure ratios varying from jet off to about 6, depending on Mach number. Low-fineness-ratio boattails had large separated-flow regions and the highest drag at all Mach numbers. Subsonic pressure-plus-friction drag levels were generally similar for boattails which did not have large separated regions. Drag-rise Mach number increased as boattail fineness ratio increased. Author

N73-23803*# Kanner (Leo) Associates, Redwood City, Calif.
CONTRIBUTION TO THE SELECTION OF THE PARAMETERS OF THE THERMODYNAMIC CYCLE IN DOUBLE FLOW TURBOJETS
Mario Albin and Massimo Feola Washington NASA May 1973 45 p refs Transl. into ENGLISH from the 27th Congr. Natl. ATI, Naples, 27-29 Sep. 1972 35 p
(Contract NASw-2481)
(NASA-TT-F-14904) Avail: NTIS HC $4.25 CSCL 21E

Double flow turbojet propulsion is discussed in terms of secondary flow capacity. The two most characteristic elements of this process are the ratios of compression and bypass of the fan. Studies are presented which show that as the bypass ratio improves global thermopropulsive efficiency it simulataneously lowers the specific thrust. Thus, in order to attain the necessary thrust, a considerable increase in the dimensions of the secondary flow (fan) is required. It is found to be possible, by manipulating the compression ratio and the temperature, to improve efficiency without appreciably reducing specific thrust. Author

N73-23804# Air Force Systems Command, Wright-Patterson AFB, Ohio. Foreign Technology Div.
KAZAN. AVIATION INSTITUTE, TRANSACTIONS (SELECTED ARTICLES)
M. N. Bodunov 26 Jan. 1973 31 p refs Transl. into ENGLISH from Tr. Aviats. Inst. (Kazan), no. 101, 1968 16 p
(AD-756101; FTD-HT-23-1741-72) Avail: NTIS CSCL 21/5

Selected articles are presented dealing with heat exchange between the gas and certain elements of the turbines's running section, heat transfer coefficients from the gas to the blades of a turbine cascade under conditions of rotations and non-stationary modes, and temperature calculation of turbine blades with effusion cooling. Author (GRA)

N73-23805# Naval Postgraduate School, Monterey, Calif.
EXPERIMENTAL DETERMINATION OF TURNING ANGLE AND LOSSES OF AXIAL COMPRESSOR INLET GUIDE VANES M.S. Thesis
William Richard Wheeler Dec. 1972 48 p refs
(AD-757250) Avail: NTIS CSCL 21/5

The investigation experimentally determined the minimum loss incidence angle, deviation angle, and total-pressure loss coefficient for a cascade with airfoil-type blade profiles used as inlet guide vanes for an axial-flow compressor with an equivalent camber angle of 37.6 degrees and unit solidity. The experimental values were compared with values predicted using correlations based on compressor cascade tests. Author (GRA)

N73-23806# Naval Postgraduate School, Monterey, Calif.
A THEORETICAL ANALYSIS OF UNSTEADY TRANSONIC CASCADE FLOW M.S. Thesis
Philip Robert Elder Dec. 1972 162 p refs
(AD-757255) Avail: NTIS CSCL 21/5

The report presents an analysis of transonic potential flow through an oscillating unstaggered thin plate cascade. A collection technique is used involving the superposition of adjacent blade isolated foil potentials with interference potentials of unknown strength. Imposition of flow tangency requirements leads to integral equations for the unknown source distributions of the interference potentials. Results presented include the interference coefficients for the steady and oscillating cases. The steady case is extended to the determination of the potentials along the blade and compares favorably with a parellel solution using a Laplace transform approach to the sonic wind tunnel wall interference problem. Author (GRA)

N73-23807# Cincinnati Univ., Ohio. Dept. of Aerospace Engineering.
CALCULATION OF THE THREE DIMENSIONAL PARTICLE TRAJECTORIES IN A ONE AND ONE-HALF STAGE OF A

COMPRESSOR
M. Fathy Hussein and W. Tabakoff Feb. 1973 95 p refs
(Contract DAHC04-69-C-0016; Proj. Themis)
(AD-757162; Rept-73-34; AROD-T-4-54-E) Avail: NTIS CSCL 21/5

The equations of motion, in three dimensions, for solid particles moving in a compressible gas flow in a rotating cascade are solved for the case of the particles moving through a compressor guide vane followed by a compressor stage. The solution considers the particle impact and rebound with both the blade walls and the compressor casing. The three dimensional absolute paths of the particles, their trajectories relative to the compressor rotor, their velocity histories, and the combined particle velocity diagrams in the compressor cascades are given. The effects of flow parameters on the dynamic behavior of the solid particles throughout the compressor one and one-half stage are investigated. (Author Modified Abstract) GRA

N73-23808# AiResearch Mfg. Co., Phoenix, Ariz.
ADVANCED, SMALL, HIGH-TEMPERATURE RISE COMBUSTOR PROGRAM Semiannual Progress Report, 1 Apr. - 30 Sep. 1972
Michael P. Wood 25 Oct. 1972 157 p refs
(Contract DAAJ02-70-C-0060; DA Proj. 1G1-62207-A-A71)
(AD-757173; PE-8120-R27) Avail: NTIS CSCL 21/5

The report is a semiannual progress report of an analytical and experimental study addressed to the problems associated with advanced, small, high temperature-rise combustors. This report summarizes work conducted during the period of April 1, 1972, to September 30, 1972. The program, initiated in June 1970, is divided into three phases, as follows: Phase I - element analysis; Phase II - conceptual design, element testing, design evaluation, and concept selection; and Phase III - combustor final design, fabrication, and testing. The report summarizes the activities during the six-month period from April 1, 1972 to September 30, 1972, during which time Phase II activities were completed and the Phase III test plan and test equipment were defined. (Author Modified Abstract) GRA

N73-23809# Von Karman Inst. for Fluid Dynamics, Rhode-Saint-Genese (Belgium). Turbomachinery Lab.
THE LOW HUB-TIP RATIO SUPERSONIC AXIAL-FLOW COMPRESSOR, VOLUME 2 Final Report, 1 Jul. 1971 - 30 Jun. 1972
Frans A. E. Breugelmans Nov. 1972 73 p refs
(Grant AF-AFOSR-2104-71; AF Proj. 7065)
(AD-757217; VKI-TN-41-Vol-2; ARL-73-0057) Avail: NTIS CSCL 21/5

The report describes the test results of a supersonic axial-flow compressor stage with a tip Mach number of 2.0. This volume discusses a method to eliminate the inlet problem.
Author (GRA)

N73-23810*# ARO, Inc., Arnold Air Force Station, Tenn.
DESIGN ASSURANCE TEST OF THE THIOKOL TE-M-521-5 APOGEE KICK MOTOR TESTED IN THE SPIN MODE AT SIMULATED ALTITUDE CONDITIONS Final Report
A. A. Cimino AEDC Mar. 1973 43 p refs Sponsored by NASA and AEDC
(NASA-CR-131987; AD-756838; ARO-ETF-TR-72-177; AEDC-TR-73-15) Avail: NTIS HC $4.25 CSCL 21/8

One Thiokol Chemical Corporation TE-M-521-5 solid-propellant apogee rocket motor was successfully fired at an average simulated altitude of about 108,000 ft while spinning at 46 rpm. The general program objectives were to verify compliance of motor performance with the manufacturer's specifications. Specific primary objectives were to determine vacuum ballistic performance of the motor after prefire vibration conditioning and temperature conditioning at 40F, altitude ignition characteristics, motor structural integrity, and motor temperature-time history during and after motor operation. Additional objectives were to measure the lateral (nonaxial) thrust component during motor operation and to measure radiation heat flux in the vicinity of the nozzle exit plane. Author (GRA)

N73-23811# Hamilton Standard, Windsor Locks, Conn.
FEASIBILITY INVESTIGATION FOR DETERMINING ARMY HELICOPTER GAS TURBINE ENGINE MAXIMUM POWER AVAILABLE Final Report
Joseph M. Kos, Anthony J. Martin, Peter D. Miller, John Saunders, and Roy W. Schneider Feb. 1973 130 p
(Contract DAAJ02-72-C-0003; DA Proj. 1F1-62203-A-434)
(AD-758461; USAAMRDL-TR-72-58) Avail: NTIS CSCL 21/5

The purpose of the investigation was to determine the feasibility of developing a method to predict, with an accuracy of better than plus or minus 1%, the maximum power which can be produced by a helicopter gas turbine engine at full-power conditions. The prediction was to be made using information obtained from the engine while the engine was operated prior to lift-off at a partial-power condition of no more than 30% of normal rated power. The prediction method was to be capable of identifying the changes in maximum engine power available due to all possible types of engine deterioration and all ambient conditions. The study was based on a Lycoming T53-L13 gas turbine engine currently being used in Army UH-1 helicopter. (Author Modified Abstract) GRA

N73-23599 National Gas Turbine Establishment, Pyestock (England).
THE ENVIRONMENT ENCOUNTERED BY HIGH TEMPERATURE COMPONENTS OF THE AIRCRAFT GAS TURBINE
J. E. Restall *In* AGARD High Temp. Corrosion of Aerospace Alloys Mar. 1973 p 11-30 refs (For availability see N73-23597 14-17)

N73-23600 Societe Nationale d'Etudes et de construction Societe Nationale d de Moteurs Aeronautiques, Corbeil (France).
MATERIALS CURRENTLY EMPLOYED IN HIGH TEMPERATURE COMPONENTS OF THE AIRCRAFT GAS TURBINE
M. Brunetaud *In* AGARD High Temp. Corrosion of Aerospace Alloys Mar. 1973 p 31-42 In FRENCH; ENGLISH summary (For availability see N73-23597 14-17)

29 SPACE RADIATION

Includes cosmic radiation; solar flares; solar radiation; and Van Allen radiation belts. For related information see also: 13 Geophysics, and 24 Physics, Atomic, Molecular, and Nuclear.

N73-23812# Institut d'Aeronomie Spatiale de Belgique, Brussels.
KINETIC MODELS OF THE SOLAR AND POLAR WINDS
J. Lemaire and M. Scherer 1973 71 p refs Submitted for publication
(Aeronomica-Acta-A-N-115-1973) Avail: NTIS HC $5.75

The application of the kinetic theory to the collisionless regions of the polar and solar winds is discussed. A brief historical review is given to illustrate the evolution of the theoretical models proposed to explain the main phenomenon and observations. The parallelism between the development of the solar wind models and the evolution of the polar wind theory is stressed, and the kinetic approaches were in both cases preceded by the hydrodynamic models. A kinetic method, based on the quasineutrality and the zero-current condition in a stationary plasma with open magnetic field lines, is described. The applicability of this approach to the solar and polar winds is illustrated by comparison of the predicted results with the observations. The kinetic models are also compared with hydrodynamic ones. It was concluded that the classical hydrodynamic descriptions are only appropriate in the collision-dominated region, whereas the kinetic theory can be applied only in the collision-free domain. Author

N73-23813# Communications Research Centre, Ottawa (Ontario).
SOLAR X-RAY FLUX DISTRIBUTION FROM 0.1 TO 8.0 A USING FLUXES MEASURED IN THE SOLRAD 9 SATELLITE
L. E. Montbriand Jan. 1973 32 p refs
(CRC-1241) Avail: NTIS HC $3.75

An evaluation is presented of a simple equation for calculating the distribution of solar X-ray flux between 0.1 and 8A. The approach is based upon the assumption that the continuum in the 0.1 to 8A region originates predominantly from a combination

of free-free and free-bound transitions. Tables of the coefficients needed in the equation are included. The equation and the coefficients convert the published Solrad 9 grey body fluxes F(0.5 - 3A) and F(1 - 8A) into corrected fluxes and give the wavelength distribution of these corrected fluxes. The flux distributions obtained are very similar to those obtained by rocket experiments. Author

N73-23814*# National Aeronautics and Space Administration. Goddard Space Flight Center, Greenbelt, Md.
ERTS/NIMBUS RADIATION ENVIRONMENT INFORMATION
E. G. Stassinopoulos Apr. 1973 96 p refs
(NASA-TM-X-66236; X-601-73-122) Avail: NTIS HC $4.00 CSCL 03B

The results of the ERTS/Nimbus satellite investigation of electron flux levels are presented. Flux calculations were made with the use of two electron environment models, both of which are static and describe the environment during the solar maximum conditions of October 1967. It is concluded that the construction of these models makes it possible to infer a change of the average quiet time electron flux levels as a function of the solar cycle. J.M.M.

N73-23815# Smithsonian Astrophysical Observatory, Cambridge, Mass.
ACTIVE SUN UV SOLAR MODELS Final Report, 1 Nov. 1971 - 31 Oct. 1972
Eugene H. Avrett Dec. 1972 17 p refs
(Contract F19628-72-C-0054; AF Proj. 8608)
(AD-755921; AFCRL-TR-73-0031) Avail: NTIS CSCL 03/2

A unique computer program called PANDORA has been developed at the Smithsonian Astrophysical Observatory for the purpose of analyzing a wide variety of solar observational data to determine the temperature and density structure of quiet and active regions of the solar chromosphere. An extensive collection of extreme-ultraviolet solar data has been obtained from rocket and satellite experiments by members of the Harvard College Observatory, and the results are available for interpretation. The computer program was used to construct theoretical models consistent with the data. The resulting models provide information about the structure of the quiet chromosphere and some preliminary characteristics of the regions in which solar activity develops. Author (GRA)

N73-23816# Air Force Cambridge Research Labs., L. G. Hanscom Field, Mass.
SIMULTANEOUS SOLAR WIND OBSERVATIONS
Paul F. Fougere 12 Jan. 1973 13 p
(AF Proj. 8601)
(AD-758194; AFCRL-TR-73-0044; AFCRL-ERP-429) Avail: NTIS CSCL 03/2

Over 1200 hours of simultaneous, interplanetary, solar wind data from the satellites Explorer 33 and 35 are compared statistically. It is concluded that the two satellites sense the same solar wind which is thus homogeneous over a distance scale of at least 140 earth radii. There are, however, systematic differences that are significantly larger than the random differences. These systematic differences are very likely due to small but not negligible calibration errors. Author (GRA)

30 SPACE SCIENCES

Includes astronomy and astrophysics; cosmology; lunar and planetary flight and exploration; and theoretical analysis of orbit and trajectory. For related information see also: 11 Facilities, Research and Support; and 31 Space Vehicles.

N73-23817*# National Aeronautics and Space Administration. Ames Research Center, Moffett Field, Calif.
MARTIAN LINEAMENTS FROM MARINER 6 AND 7 PHOTOGRAPHS
Peter H. Schultz and F. Earl Ingerson (Texas Univ., Austin) Apr. 1973 36 p refs Prepared in cooperation with Texas Univ., Austin
(Grant NGR-44-012-194)
(NASA-TM-X-62264) Avail: NTIS HC $4.00 CSCL 22C

Mariner 6 and 7 photographs were used to investigate the nature and importance of linear surface trends on Mars. Cross correlations of frequency-azimuth distributions of linear trends from different Mariner frames indicate that lineations not recognized as topographic features have a component of pseudoforms, probably introduced during digital reconstruction of the pictures. Similar statistical tests may aid in the analysis of surface trends from future satellites and space probes. The most reliable data were separated into photometrically defined provinces. Meridiani Sinus and Margaritifer Sinus display five major trends in common, which are interpreted as extensions of crustal weaknesses related to the enormous equatorial canyon revealed in Mariner 6 and 9 pictures. Alignments of crater wall segments generally match these trends and suggest structural control of crater plan. Crater chains, however, do not match these trends and are interpreted as secondary impacts. Rose diagrams of lineations in Deucalionis Regio exhibit much more complexity and are believed to reflect a better preserved or more complex geologic history. Author

N73-23818# Laboratoire de Physique Theorique et des Hautes Energies, Orsay (France).
MATTER-ANTIMATTER COSMOLOGY: THE RADIATIVE PERIOD
R. Aldrovandi, S. Caser, R. Omnes, and J. L. Puget (Meudon Obs.) Feb. 1973 58 p refs
(LPTHE-73/5) Avail: NTIS HC $5.00

The kinetics of high energy particles produced along the boundary of the matter-antimatter emulsion of a symmetric universe during the radiative period are analyzed. It is shown that there exists a pressure discontinuity across the boundary which is of the Laplace-Kelvin form, thus implying the existence of a coalescence effect. The kinetics of thermal photons are also studied and hydrodynamical equations are derived for radiation and plasma components. The annihilation rate at the boundary is computed and the rate of growth of the emulsion with time is derived by averaging over a large volume. The mean mass of galaxies is roughly estimated and found to be comparable with the observed value, which proves the efficiency of the coalescence process. Author

N73-23819# Laboratoire de Physique Theorique et des Hautes Energies, Orsay (France).
PHYSICS AT THE ORIGIN OF TIME
R. Omnes Feb. 1973 32 p refs Presented at 6th Tex. Meeting on Relativistic Astrophys., N. Y., Dec. 1972
(LPTHE-73/4) Avail: NTIS HC $3.75

The existence of antimatter in the Universe is discussed. The topics considered include: geometrical background of cosmology, thermal radiation, matter, nucleon-antinucleon separation, and coalescence effect. F.O.S.

N73-23820# Lockheed Missiles and Space Co., Palo Alto, Calif.
ON OSCILLATIONS OF THE EARTH'S MAGNETIC TAIL IN THE QUASIHYDRODYNAMICS APPROXIMATION
A. I. Ershkovich and S. A. Martianov [1973] 7 p refs Transl. into ENGLISH from Geomagnetizm i Aeronomiya (Moscow), v. 13, no. 1, 1973 p 110-115
Avail: NTIS HC $3.00; National Translations Center, John Crerar Library, Chicago, Ill. 60616

Oscillations of the earth's magnetic tail are examined in the model of a plasma cylinder with a free boundary, on the basis of the Chew-Goldenberger-Low equations. A dispersion equation is obtained for the oscillations and its approximate solution is found and then compared with the results obtained on the basis of one-fluid magnetohydrodynamics with perfect conductivity. It is shown that the long-period variations in the magnetic field (with a period of several tens to several hundreds of minutes) can be the appearance of natural oscillations of the earth's magnetic tail. Author

N73-23821# Lockheed Missiles and Space Co., Palo Alto, Calif.
INFLUENCE OF PRESSURE ANISOTROPY ON OSCILLATIONS OF THE MAGNETOSPHERE TAIL
A. I. Ershkovich and S. A. Martianov [1972] 9 p refs Transl. into ENGLISH from Kosmich. Issled. (Moscow), V. 11, no. 1,

1973 p 80-87
Avail: NTIS HC $3.00; National Translations Center, John Crerar Library, Chicago, Ill. 60616

The influence of pressure anisotropy on magnetosphere tail oscillations is studied by using the Chew-Goldberger-Low quasihydrodynamics equations. It is shown that the pressure anisotropy of the solar wind plasma can result in the origination of oscillations if there were none for isotropy, and the pressure anisotropy of the plasma in the geomagnetic tail can result in an essential change in the character of already existing oscillations, for example, to the appearance of oscillations along the radius in the tail. Author

N73-23822*# National Aeronautics and Space Administration. Goddard Space Flight Center, Greenbelt, Md.
STATUS OF AVAILABILITY OF MARINER 9 (1971-051A) TV PICTURE DATA Data Announcement Bulletin
[1973] 24 p
(NASA-TM-X-69216; NSSDC-73-03) Avail: NTIS HC $3.25 CSCL 22C

The Mariner 9 TV data that are now available from the National Space Science Data Center are described. Included are the mission test video system pictures, image processing laboratory/reduced data records, mosaics, and journal articles. F.O.S.

N73-23823*# California Inst. of Tech., Pasadena.
GRAND TOUR OUTER PLANET MISSIONS DEFINITION PHASE. PART 1: QUANTITATIVE IMAGING OF THE OUTER PLANETS AND THEIR SATELLITES
Michael J. S. Belton (Kitt Peak Natl. Obs.), Kaare Aksnes (Smithsonian Astrophys. Obs.), Merton E. Davies (Rand Corp.), William K. Hartmann (IITRI), Robert L. Millis (Lowell Obs.), Tobias Owen (State Univ. of N. Y.), Terrance H. Reilly (JPL), Carl Sagan (Cornell Univ.), Verner E. Suomi (Wisc. Univ.), and Stewart A. Collins (JPL) 1 Feb. 1972 81 p refs
(Contracts NASw-2227; NASw-2226; Grants NGR-03-007-006; NGR-09-015-184; NGR-03-003-016; NGR-33-015-149; NGR-33-010-151; NGR-50-002-170)
(NASA-CR-132013) Avail: NTIS HC $6.25 CSCL 22A

A recommended imaging system is outlined for use aboard the Outer Planet Grand Tour Explorer. The system features the high angular resolution capacity necessary to accommodate large encounter distances, and to satisfy the demand for a reasonable amount of time coverage. Specifications for all components within the system are provided in detail. J.M.M.

N73-23824*# California Inst. of Tech., Pasadena.
GRAND TOUR OUTER PLANET MISSIONS DEFINITION PHASE. PART 2: MINUTES OF MEETINGS AND OFFICIAL CORRESPONDENCE
Michael J. S. Belton (Kitt Peak Natl. Obs.), Kaare Aksnes (Smithsonian Astrophys. Obs.), Merton E. Davies (Rand Corp.), William K. Hartmann (IITRI), Robert L. Millis (Lowell Obs.), Tobias Owen (State Univ. of N. Y.), Terrance H. Reilly (JPL), Carl Sagan (Cornell Univ.), Verner E. Suomi (Wisc. Univ.), and Stewart A. Collins (JPL) 1 Feb. 1972 121 p
(Contracts NASw-2227; NASw-2226; Grants NGR-03-007-006; NGR-09-015-184; NGR-03-003-016; NGR-33-015-149; NGR-33-010-151; NGR-50-002-170)
(NASA-CR-132014) Avail: NTIS HC $8.25 CSCL 22A

A variety of imaging systems proposed for use aboard the Outer Planet Grand Tour Explorer are discussed and evaluated in terms of optimal resolution capability and efficient time utilization. It is pointed out that the planetary and satellite alignments at the time of encounter dictate a high degree of adaptability and versatility in order to provide sufficient image enhancement over earth-based techniques. Data compression methods are also evaluated according to the same criteria. J.M.M.

N73-23825*# California Inst. of Tech., Pasadena.
MJS IMAGING EXPERIMENT: MARINER JUPITER-SATURN MISSION DEFINITION PHASE
Michael J. S. Belton, Kaare Aksnes, Merton E. Davies, William K. Hartmann, Robert L. Millis, Torias Owen, Terrance H. Reilly, Carl Sagan, Verner E. Suomi, and Stewart A. Collins 1 May 1972 14 p Prepared in cooperation with Smithsonian Astrophys. Obs., RAND Corp., IIT Res. Inst., Lowell Obs., Cornell Univ., and Wisc. Univ.
(Contracts NASw-2227; NASw-2226; Grants NGR-03-007-006; NGR-09-015-184; NGR-03-003-016; NGR-33-015-149; NGR-50-002-170)
(NASA-CR-132012) Avail: NTIS HC $3.00 CSCL 22A

Guidelines are suggested for MJS imaging. The capabilities of the baseline TV system are briefly evaluated, along with instrumental development. Trajectory and sequencing criteria are also included. J.A.M.

N73-23826# Leander McCormick Observatory, Charlottesville, Va.
INTERFEROMETER BASELINES AND POLES OBTAINED BY LINKING RADIO OBSERVATORIES
Thomas E. Corbin and Samuel J. Goldstein, Jr. 1972 25 p refs *Its* Publications, Volume 11, Part 27
Avail: NTIS HC $3.25

Tables are presented of measurements on the angular structure of quasars and interstellar masers. Long baseline interferometers and poles linked with radio observatories are used to collect the data. E.H.W.

N73-23827# Smithsonian Astrophysical Observatory, Cambridge, Mass.
METEORITES
[1972] 28 p refs
(SAO-909-42) Avail: NTIS HC $3.50

An introduction is presented on the origin, composition, and physical characteristics of meteorites. Emphasis is placed on techniques to determine the authenticity of meteorites according to properties of porosity, irregularity of shape, and the presence of surface metallic iron. A concise eyewitness account of the sighting of a meteor in its descent trajectory is provided in order to focus attention on the dynamics of atmospheric encounter. J.M.M.

N73-23828# Hale Observatories, Pasadena, Calif.
[PROGRESS REPORT ON ASTROPHYSICS, GALAXIES, AND STELLAR SPECTROSCOPY, FOR 1971 - 1972] Annual Report, 1971 - 1972
Horace W. Babcock Dec. 1972 72 p refs Repr. from Carnegie Inst. Year book 71, Dec. 1971
Avail: NTIS HC $5.75

Research highlights are reported. Studies in the following areas are included: Hg-Mn stars, He-weak stars, supernovae, red variable stars, blue galaxies, radio galaxies, and quasars. F.O.S.

N73-23829*# Stanford Research Inst., Menlo Park, Calif.
PROBABILISTIC MODELS OF PLANETARY CONTAMINATION
J. Michael Harrison and D. Warner North Apr. 1973 52 p refs
(Contract NASw-2451; SRI Proj. MSU-2274)
(NASA-CR-132001) Avail: NTIS HC $4.75 CSCL 03B

Likely fundamental inadequacies in the model of planetary contamination advanced by Sagan and Coleman are discussed. It is shown that a relatively minor modification of the basic Sagan-Coleman formula yields approximations that are generally adequate with data in the range of interest. This approximation formula differs from the original Sagan-Coleman version only through an initial conditioning on landing outcome. It always yields an upper (conservative) bound for the total probability of contamination, this appealing feature is lost if the conditioning on landing outcome is deleted. Author

N73-23830*# Translation Consultants, Ltd., Arlington, Va.
THE ANDROMEDA GALAXY
Ya. E. Eynasto and M. M. Yyeveer Washington NASA May 1973 26 p refs Transl. into ENGLISH from Priroda (USSR), no. 11, 1972 p 70-80
(Contract NASw-2038)
(NASA-TT-F-14839) Avail: NTIS HC $3.50 CSCL 03B

The Andromeda galaxy has been investigated and a model of it has been calculated mathematically. Author

N73-23831*# Translation Consultants, Ltd., Arlington, Va.
NEW FACTS ON MARS' GEOLOGY
P. N. Kropotkin Washington NASA May 1973 6 p refs Transl. into ENGLISH from Priroda (USSR) no. 11, 1972 p 88-89
(Contract NASw-2038)
(NASA-TT-F-14840) Avail: NTIS HC $3.00 CSCL 03B

Geological features on the Martian surface are briefly discussed as interpreted from Mariner 9 photographs. F.O.S.

N73-23832*# Scripta Technica, Inc., Washington, D.C.
ROLE OF METASTABLE ATOMS O(PRIME D) IN THERMOSPHERIC HEATING
O. G. Lisin Washington NASA May 1973 6 p refs Transl. into ENGLISH from Acad. of Sci., USSR, Inst. for Space Res. report Pr-125, Moscow, 1972 8 p
(Contract NASw-2484)
(NASA-TT-F-14901; PR-125) Avail: NTIS HC $3.00 CSCL 03B

The oxygen atom deactivation process O (D) has a significant influence on the thermal balance of the thermosphere. These atoms form the intermediate complex N2O when they collide with nitrogen molecules. A study of the electron oscillation energy exchange during deactivation with complex formation has shown that the energy of the O (D) level is primarily converted into translational degrees of freedom, and the energy yield in oscillatory form may be disregarded in calculating a model of the thermosphere. Author

N73-23833*# National Aeronautics and Space Administration, Washington, D.C.
ASTRONAUTICS AND AERONAUTICS, 1970. CHRONOLOGY ON SCIENCE, TECHNOLOGY, AND POLICY
1972 519 p refs Prepared by Library of Congr.
(NASA-SP-4015; LC-CC-65-60308) Avail: NTIS MF $0.95; SOD HC $3.10 Domestic Postpaid or $2.75 GPO Bookstore CSCL 22C

An immediate reference to aerospace-related events of 1970 is provided to help historians in preserving historical accuracy and precision. Chronologies of major NASA launches, and manned space flights for 1970 are included. F.O.S.

N73-23834# Smithsonian Astrophysical Observatory, Cambridge, Mass.
ENCYCLOPEDIA: STAR
Owen J. Gingerich [1972] 22 p
Avail: NTIS HC $3.25

Stellar terms are defined in the following categories: physical properties, peculiar stars, energy production, and stellar evolution. F.O.S.

N73-23835*# Massachusetts Inst. of Tech., Cambridge. Center for Space Research.
SURFACE ELECTRICAL PROPERTIES EXPERIMENT STUDY PHASE, VOLUME 1 Final Report
James W. Meyer, Richard H. Baker, and Leonard B. Johnson Jan. 1973 213 p refs 3 Vol.
(Contract NAS9-10748)
(NASA-CR-128918) Avail: NTIS HC $12.75 CSCL 22A

The evolution of a conceptual design of the flight hardware for the surface electrical properties experiment (SEP), the definition of requests for proposals, the analysis of proposals submitted by prospective flight hardware subcontractors, and recommendations for the flight configuration to be implemented are discussed. Initial efforts were made to assess the electromagnetic environment of the SEP experiment. An EMI receiver and tri-loop antenna were constructed and tests of opportunity were performed with a lunar roving vehicle (LRV). Initial analyses were made of data from these tests with support from this contract, analyses which were continued in depth under the hardware contract. Author

N73-23836*# Massachusetts Inst. of Tech., Cambridge. Center for Space Research.
SURFACE ELECTRICAL PROPERTIES EXPERIMENT STUDY PHASE, VOLUME 2 Final Report
Jan. 1973 345 p refs 3 Vol.
(Contract NAS9-10748)
(NASA-CR-128919) Avail: NTIS HC $19.25 CSCL 22A

The choice of an antenna for a subsurface radio sounding experiment is discussed. The radiation properties of the antennas as placed on the surface of the medium is examined. The objective of the lunar surface electrical properties experiment is described. A numerical analysis of the dielectric permittivity and magnetic permeability of a subsurface domain is developed. The application of electromagnetic field measurements between one or more transmitting antennas and a roving receiving station is explained. Author

N73-23837*# Massachusetts Inst. of Tech., Cambridge. Center for Space Research.
SURFACE ELECTRICAL PROPERTIES EXPERIMENT STUDY PHASE, VOLUME 3 Final Report
Jan. 1973 466 p refs 3 Vol.
(Contract NAS9-10748)
(NASA-CR-128920) Avail: NTIS HC $25.50 CSCL 22A

The reliability and quality assurance system and procedures used in developing test equipment for the Lunar Experiment projects are described. The subjects discussed include the following: (1) documentation control, (2) design review, (3) parts and materials selection, (4) material procurement, (5) inspection procedures, (6) qualification and special testing, and failure modes and effects analysis. Author

N73-23838*# Techtran Corp., Silver Spring, Md.
RENDEZVOUS IN ORBIT
V. Anuchin Washington NASA May 1973 10 p Transl. into ENGLISH from Aviats. i Kosmonavt. (Moscow), no. 2, Feb. 1971 p 30-31
(Contract NASw-2485)
(NASA-TT-F-13955) Avail: NTIS HC $3.00 CSCL 22A

Problems of orbital mechanics are discussed which relate to the orbital station in space with minimal energy consumption (and therfore maximum payload). Carefully timed launching and orbital maneuvers are described, and the possibility of a parking orbit is mentioned. Author

N73-23839*# Techtran Corp., Silver Spring, Md.
SPACE AND PRODUCTION
A. Koval Washington NASA May 1973 8 p refs Transl. into ENGLISH from Aviat. Kosmonavt. (Moscow), no. 4, 1971 p 34-35
(Contract NASw-2485)
(NASA-TT-F-13958) Avail: NTIS HC $3.00 CSCL 22A

The cosmization of the economy, in accordance with Marxist theory, which will lead to enormous gains in production and improvement is discussed. Author

N73-23840*# IIT Research Inst., Chicago, Ill. Astro Sciences Center.
COST ESTIMATION FOR UNMANNED LUNAR AND PLANETARY PROGRAMS
J. H. Dunkin, P. R. Pekar, D. J. Spadoni, and C. A. Stone Jan. 1973 115 p
(NASA-CR-131897; C-10) Avail: NTIS HC $7.75 CSCL 22A

A basic model is presented for estimating the cost of unmanned lunar and planetary programs. Cost data were collected and analyzed for eight lunar and planetary programs. Total cost was separated into the following components: labor, overhead, materials, and technical support. The study determined that direct labor cost of unmanned lunar and planetary programs comprises 30 percent of the total program cost. Twelve program categories were defined for modeling: six spacecraft subsystem categories (science, structure, propulsion, electrical power, communications, and guidance and integration, test and quality assurance, launch and flight operations, ground equipment, systems analysis and engineering, and program management). An analysis showed that on a percentage basis, direct labor cost and direct labor manhours compare on a one-to-one ratio. Therefore, direct labor hours is used as the parameter for predicting cost, with the advantage of eliminating the effect of inflation on the analysis. Author

N73-23841*# Lockheed Missiles and Space Co., Huntsville, Ala. Research and Engineering Center.
STUDY OF HYPERVELOCITY METEOROID IMPACT ON ORBITAL SPACE STATIONS Final Report
K. R. Leimbach and R. J. Prozan Apr. 1973 39 p refs
(Contract NAS8-28473)

(NASA-CR-124241; HREC-8473-1; LMSC/HREC-TR-D306582) Avail: NTIS HC $4.00 CSCL 03B

Structural damage resulting in hypervelocity impact of a meteorite on a spacecraft is discussed. Of particular interest is the backside spallation caused by such a collision. To treat this phenomenon two numerical schemes were developed in the course of this study to compute the elastic-plastic flow fracture of a solid. The numerical schemes are a five-point finite difference scheme and a four-node finite element scheme. The four-node finite element scheme proved to be less sensitive to the type of boundary conditions and loadings. Although further development work is needed to improve the program versatility (generalization of the network topology, secondary storage for large systems, improving of the coding to reduce the run time, etc.), the basic framework is provided for a utilitarian computer program which may be used in a wide variety of situations. Analytic results showing the program output are given for several test cases.

Author

N73-23842*# Polytechnic Inst. of Brooklyn, Farmingdale, N.Y. Dept. of Electrical Engineering and Electrophysics.

A STUDY OF THE EVOLUTION OF THE ATMOSPHERE OF VENUS Final Report, 1 Jan. - 31 Dec. 1972

S. H. Gross 19 Mar. 1973 15 p refs

(Grant NGR-33-006-062)

(NASA-CR-132025; PIBEP-73-124) Avail: NTIS HC $3.00 CSCL 03B

The escape mechanism was studied which results in blow-off of an atmosphere. The planets and satellites were investigated in this respect from an evolutionary standpoint along with comets and the solar wind because of similarities. Both static and dynamic studies were made of upper atmospheric regions for neutral and for fully ionized media. It was found that variation with more than one dimension is essential.

Author

N73-23843*# Smithsonian Astrophysical Observatory, Cambridge, Mass.

INVESTIGATION OF ULTRAVIOLET INTERSTELLAR EXTINCTION Semiannual Progress Report, 1 Oct. 1972 - 31 Mar. 1973

Cecilia Payne-Gaposchkin and Katherine L. Haramundanis 31 Mar. 1973 19 p refs

(Grant NGR-09-015-200)

(NASA-CR-131990; SAPR-1) Avail: NTIS HC $3.00 CSCL 03B

The progress made during the past six months in utilizing Celescope OAO-2 data in a study of extinction is reported along with conclusions drawn from each inquiry. Areas recommended for further investigation are indicated.

Author

N73-23844*# National Aeronautics and Space Administration. Lyndon B. Johnson Space Center, Houston, Tex.

APOLLO 17 MISSION REPORT

Mar. 1973 315 p refs

(NASA-TM-X-69292; JSC-07904) Avail: NTIS HC $17.75 CSCL 03B

Operational and engineering aspects of the Apollo 17 mission are outlined. The vehicle configuration was similar to those of Apollo 15 and 16. There were significant differences in the science payload for Apollo 17 and spacecraft hardware differences and experiment equipment are described. The mission achieved a landing in the Taurus-Littrow region of the moon and returned samples of the pre-Imbrium highlands and young craters.

Author

N73-23845*# National Aeronautics and Space Administration, Washington, D.C.

STUDY OF AN EVOLUTIONARY INTERIM EARTH ORBIT PROGRAM

Joseph L. Anderson, Larry R. Alton, Roger D. Arno, Jerry M. Deerwester, Larry E. Edsinger, Kenneth F. Sinclair, Edward L. Tindle, and Richard D. Wood 6 Apr. 1971 135 p refs

(NASA-TM-X-69243; MS-1) Avail: NTIS HC $8.75 CSCL 22A

An evolutionary, gradual, and step-wise spacecraft systems technology development from those used on the Apollos and Skylab 1 to that required for the space station was considered. The four mission spacecraft were dry workshop versions of the Saturn 4-B stage, and each individually configured, outfitted and launched by INT-21 vehicles. These spacecraft were evaluated for crews of three, six and nine men and for mission lifetimes of one year. Two versions of the Apollo CSM, a three man and a four man crew, were considered as the logistic vehicle. The solar cell electrical power system of the first mission evolves into a light weight panel system supplemented by an operating isotope-Brayton system on the later missions. The open life support system of the first mission evolves to a system which recovers both water and oxygen on the last mission. The data handling, communications, radiation shielding, micrometeoroid protection, and orbit keeping systems were determined. The program costs were estimated and, excluding operational costs, the cost for each mission would average about $2 billion of which one-sixth would be for development, one-fourth for experiments, and the balance for vehicle acquisition.

Author

N73-23846*# Princeton Univ. Observatory, N.J.

HIGH-RESOLUTION IMAGERY OF URANUS OBTAINED BY STRATOSCOPE 2

R. E. Danielson, M. G. Tomasko, and B. D. Savage 12 Jun. 1972 37 p refs Prepared in cooperation with Ariz. Univ. and Wis. Univ.

(Grants NGR-31-001-001; NGR-31-001-142; NSF GP-23580) (NASA-CR-132024) Avail: NTIS HC $4.00 CSCL 03A

From 17 photographs of Uranus obtained by Stratoscope 2, a composite image has been produced having a Gaussian point spread function with a half maximum intensity diameter of 0.2. No certain surface markings are visible. If there are any faint belts parallel to the rotation equator they have a maximum contrast of 5%. The measured limb darkening does not agree with either a deep Rayleigh atmosphere or with clouds high in the atmosphere; a cloud deck under a finite Rayleigh atmosphere seems to be indicated. The equatorial diameter of Uranus is measured to be 51,800 plus or minus 600 km and the ellipticity is estimated to be 0.01 plus or minus 0.01.

Author

N73-23847# Groupe de Recherches de Geodesie Spatiale, Paris (France).

FLUID TIDAL EFFECTS ON SATELLITE ORBIT AND OTHER TEMPORAL VARIATIONS IN THE GEOPOTENTIAL

Kurt Lambeck and Anny Cazenave Jan. 1973 46 p refs

(GRGS-Bull-7) Avail: NTIS HC $4.50

Perturbations in the motion of close earth satellites arise from the atmospheric and ocean tides. As the frequency spectrum of these perturbations is the same as those generated by the solid earth tides these fluids have to be taken into consideration when estimating the solid earth Love numbers. Variations in the geopotential arising from seasonal variations in the earth's inertia tensor were also estimated. The J sub 2 term in the geopotential is expected to show a semi-annual variation of 8.7 to the minus 10th power and an annual variation of 1.4 1to the minus 10th power.

Author (ESRO)

N73-23848# Air Force Systems Command, Wright-Patterson AFB, Ohio. Foreign Technology Div.

EQUIPMENT FOR THE RADAR INVESTIGATIONS OF METEORS IN DUSHANBE

R. P. Chevotarev, V. N. Sidorin, G. A. Polushkin, R. Sh. Bibarsov, and Sh. O. Isamutdinov 30 Jan. 1973 14 p refs Transl. into ENGLISH from Byull. Akad. Nauk Tadzhiksk. SSR, Inst. Astrofiz. (Dushanbe), no. 55, 1970 p 24-28

(AF Proj. 4506)

(AD-756100; FTD-HT-23-1720-72) Avail: NTIS CSCL 04/1

The article describes the equipment built at the Astrophysics Institute of the Tadzhik branch of the U.S.S.R. Academy of Sciences for the measurement of upper atmospheric winds according to the IQSY program, for determining the coordinates, altitudes, radiants, and velocities of meteors, and for studying the physics of meteors and the upper atmosphere. Brief data concerning the equipment's operation is presented.

Author (GRA)

N73-23849# Air Force Cambridge Research Labs., L. G. Hanscom Field, Mass.

GEOPHYSICS AND SPACE DATA BULLETIN, VOLUME 9, NO. 3 Third Quarter, 1972

Anne L. Carrigan, ed. Dec. 1972 298 p refs

(AF Proj. 8666)
(AD-755839; AFCRL-72-0707; AFCRL-SR-149) Avail: NTIS CSCL 03/2

The Bulletin is a quarterly publication that contains AFCRL contract and inhouse data reported from sites throughout the world. The following types of data are contained within each issue: magnetometer, cosmic ray, ELF noise, riometer, solar optical and radio emission, and ionosonde. This issue covers such data for July, August, and September 1972. Author (GRA)

N73-23850# Naval Weapons Lab., Dahlgren, Va.
NEW ORBITAL ELEMENTS FOR MOON AND PLANETS
C. Oesterwinter and C. J. Cohen Mar. 1972 150 p refs
(AD-755164; NWL-TR-2693) Avail: NTIS CSCL 03/3

A simultaneous solution is made for the orbital elements of moon and planets. A modern Cowell integrator is used for orbit computations, and least-squares fits are made to some 40,000 optical observations taken since 1913. The model includes relativistic terms, the leading zonal harmonics of earth and moon, the precession of the lunar equator, and the tidal couple between earth and moon. The solution also yields an extrapolation of the atomic time scale back to 1912.5. This solution is believed to be the only simultaneous improvement of the orbits of moon and planets. The simultaneity is found to be an essential feature in separating the moon's mean motion, the lunar tidal deceleration, and the corrections to the earth rotation rate. It is now possible to refer all astronomical events of the past 60 years to a time with uniform rate, namely the atomic clock system. Considering the long baseline, this model should facilitate the prediction of fast variables, such as the lunar longitude, with considerably increased confidence.
Author (GRA)

N73-23886 Consiglio Nazionale delle Ricerche, Genoa (Italy).
DETERMINATION OF AN OPTIMAL TRAJECTORY IN THE PRESENCE OF RISK
A. Tiano, P. Dagnino, and M. Piattelli *In* AGARD Automation in Manned Aerospace Systems Mar. 1973 19 p refs (For availability see N73-23881 14-31)

31 SPACE VEHICLES

Includes launch vehicles; manned space capsules; clustered and multistage rockets; satellites; sounding rockets and probes; and operating problems. For basic research see: 30 Space Sciences. For related information see also: 28 Propulsion Systems; and 32 Structural Mechanics.

N73-23851*# National Aeronautics and Space Administration. Marshall Space Flight Center, Huntsville, Ala.
SKYLAB ATTITUDE CONTROL AND ANGULAR MOMENTUM DESATURATION WITH ONE DOUBLE-GIMBALED CONTROL MOMENT GYRO
Hans F. Kennel 12 Jan. 1973 51 p refs
(NASA-TM-X-64746) Avail: NTIS HC $4.75 CSCL 22B

In case two control moment gyros fail, attitude control of Skylab can be maintained with the thruster attitude control system. This results, however, in a severely increased fuel consumption, depleting the fuel in a few days. Therefore, an alternate concept was developed which does not have large fuel consumption under any circumstances. In this concept the attitude reference is commanded to oscillate in the orbital plane with twice the orbital frequency and the remaining control moment gyro controls about orbital north and about the minimum moment-of-inertia axis, while the thruster attitude control system controls rate only about the remaining axis. This rate control in conjunction with the restoring torque due to the gravity gradient will keep bounded the excursion of the minimum moment-of-inertia axis out of the orbital plane. This alternate concept has the additional advantage that it needs no information on the principal moment-of-inertia axes misalignment and is completely insensitive to star tracker failure. Proper phasing of the attitude reference oscillation even allows angular momentum desaturation, which is responsible for the insensitivity of the thruster fuel consumption to unknown disturbances, like vent torques and magnetic torques. Author

N73-23852*# National Aeronautics and Space Administration. Goddard Space Flight Center, Greenbelt, Md
THE NIMBUS 2 DATA CATALOG. VOLUME 5: 1 OCTOBER - 15 NOVEMBER 1966 (ORBITS 1847-2458)
Dec. 1966 282 p Prepared by Allied Research Associates, Inc., Concord, Mass.
(Proj. Nimbus)
(NASA-TM-X-69886) Avail: NTIS HC $16.25 CSCL 22C

Documentation of meteorological and geomorphological data acquired from the Nimbus 2 meteorological satellite is provided. The observation period extends from 1 October through 15 November 1966. In addition, supplemental and amended data for previous volumes are included. Author

N73-23853*# Martin Marietta Corp., Denver, Colo.
LONG LIFE ASSURANCE STUDY FOR MANNED SPACECRAFT LONG LIFE HARDWARE. VOLUME 1: SUMMARY OF LONG LIFE ASSURANCE GUIDELINES Final Report
Dec. 1972 135 p refs 5 Vol.
(Contract NAS9-12359)
(NASA-CR-128905; MCR-72-169-Vol-1) Avail: NTIS HC $8.75 CSCL 22B

A long life assurance program for the development of design, process, test, and application guidelines for achieving reliable spacecraft hardware was conducted. The study approach consisted of a review of technical data performed concurrently with a survey of the aerospace industry. The data reviewed included design and operating characteristics, failure histories and solutions, and similar documents. The topics covered by the guidelines are reported. It is concluded that long life hardware is achieved through meticulous attention to many details and no simple set of rules can suffice. Author

N73-23854*# Martin Marietta Corp., Denver, Colo.
LONG LIFE ASSURANCE STUDY FOR MANNED SPACECRAFT LONG LIFE HARDWARE. VOLUME 2: LONG LIFE ASSURANCE STUDIES OF EEE PARTS AND PACKAGING Final Report
Dec. 1972 403 p refs 5 Vol.
(Contract NAS9-12359)
(NASA-CR-128906; MCR-72-169-Vol-2) Avail: NTIS HC $22.25 CSCL 22B

Guidelines for the design, development, and fabrication of electronic components and circuits for use in spacecraft construction are presented. The subjects discussed involve quality control procedures and test methodology for the following subjects: (1) monolithic integrated circuits, (2) hybrid integrated circuits, (3) transistors, (4) diodes, (5) tantalum capacitors, (6) electromechanical relays, (7) switches and circuit breakers, and (8) electronic packaging. Author

N73-23855*# Martin Marietta Corp., Denver, Colo.
LONG LIFE ASSURANCE STUDY FOR MANNED SPACECRAFT LONG LIFE HARDWARE. VOLUME 3: LONG LIFE ASSURANCE STUDIES OF COMPONENTS Final Report
Sep. 1972 639 p refs 5 Vol.
(Contract NAS9-12359)
(NASA-CR-128907; MCR-72-169-Vol-3) Avail: NTIS HC $34.00 CSCL 22B

The guidelines for selecting hardware to be used in manned spacecraft to obtain a five year operational lifetime without maintenance were developed. An analysis was conducted on the design, application, failure mechanisms, manufacturing processes and controls, screen and burn-in techniques, and quality control of hardware items. The equipment considered for evaluation include: (1) electric motors and bearings; (2) accelerometers; (3) gyroscopes and bearings; (4) compressors and pumps, (5) magnetic tape recorders; (6) plumbing components and tubing; (7) check valves; (8) pressure regulators and solenoid valves; (9) thermal control valves; (10) pressure vessels and positive expulsion devices; (11) nickel cadmium batteries; and (12) transduncers. Author

N73-23856*# Martin Marietta Corp., Denver, Colo.
LONG LIFE ASSURANCE STUDY FOR MANNED SPACECRAFT LONG LIFE HARDWARE. VOLUME 4: SPECIAL LONG LIFE ASSURANCE STUDIES Final Report
Sep. 1972 321 p refs 5 Vol.

(Contract NAS9-12359)
(NASA-CR-128908; MCR-72-169-Vol-4) Avail: NTIS HC $18.25 CSCL 22B

Guidelines for the selection of equipment to be used for manned spacecraft in order to assure a five year maintenance-free service life were developed. A special study was conducted to determine the adequacy of the procedures used to determine the quality and effectiveness of various components. The subjects examined are: (1) temperature cycling for acceptance of electronic assemblies; (2) accelerated testing techniques; (3) electronic part screening techniques; (4) electronic part derating practices; (5) vibration life extension of printed circuit board assemblies; and (6) tolerance funnelling and test requirements. Author

N73-23857*# Martin Marietta Corp., Denver, Colo.
LONG LIFE ASSURANCE STUDY FOR MANNED SPACECRAFT LONG LIFE HARDWARE. VOLUME 5: LONG LIFE ASSURANCE TEST AND STUDY RECOMMENDATIONS Final Report
Dec. 1972 11 p refs 5 Vol.
(Contract NAS9-12359)
(NASA-CR-128909; MCR-72-169-Vol-5) Avail: NTIS HC $3.00 CSCL 22B

A study was conducted to establish the guidelines to be applied to the selection of equipment for manned spacecraft systems. Recommendations for expansion of the original study are submitted. The subjects considered are: (1) designing to severe dynamic requirements; (2) analysis of in-space failures due to life limitations; (3) accelerated testing of semiconductors; (4) fan life verification; (5) testing of solid tantalum capacitors; (6) testing of teflon valve seats; and (7) electromigration model verification. Author

N73-23858*# National Aeronautics and Space Administration. Goddard Space Flight Center, Greenbelt, Md.
IMPROVED ITOS ATTITUDE CONTROL SYSTEM WITH HALL GENERATOR BRUSHLESS MOTOR AND EARTH-SPLITTING TECHNIQUE
William M. Peacock Aug. 1971 49 p refs
(NASA-TM-X-66232; X-480-71-404) Avail: NTIS HC $4.50 CSCL 22B

The ITOS with an improved attitude control system is described. A Hall generator brushless dc torque motor will replace the brush dc torque motor on ITOS-I and ITOS-A (NOAA-1). The four attitude horizon sensors will be replaced with two CO2 sensors for better horizon definition. An earth horizon splitting technique will be used to keep the earth facing side of the satellite toward earth even if the desired circular orbit is not achieved. The external appearance of the pitch control subsystem differs from TIROS-M (ITOS-1) and ITOS-A (NOAA-1) in that two instead of one pitch control electronics (PCE) boxes are used. Two instead of four horizon sensors will be used and one instead of two mirrors will be used for sensor scanning. The brushless motor will eliminate the requirement for brushes, strain gages and the telemetry for the brush wear. A single rotating flywheel, supported by a single bearing provides the gyroscopic stability and the required momentum interchange to keep one side of the satellite facing the earth. Magnetic torquing against the earth's magnetic field eliminates the requirement for expendable propellants which would limit satellite life in orbit. Author

N73-23859*# Teledyne Brown Engineering, Huntsville, Ala.
SKYLAB EXPERIMENT PERFORMANCE EVALUATION MANUAL. APPENDIX E: EXPERIMENT M512 MATERIALS PROCESSING FACILITY (MSFC)
O. H. Thomas, Jr. May 1973 140 p refs
(Contract NAS8-21804)
(NASA-CR-61386-App-E) Avail: NTIS HC $9.00 CSCL 22C

Analyses for Experiment M512, Materials Processing Facility (MSFC), to be used for evaluating the performance of the Skylab corollary experiments under preflight, inflight, and post-flight conditions are presented. Experiment contingency plan workaround procedure and malfunction analyses are presented in order to assist in making the experiment operationally successful. Author

N73-23860*# Teledyne Brown Engineering, Huntsville, Ala.
SKYLAB EXPERIMENT PERFORMANCE EVALUATION MANUAL. APPENDIX F: EXPERIMENT M551 METALS MELTING (MSFC)
M. S. Byers May 1973 119 p refs
(Contract NAS8-21804)
(NASA-CR-61386-App-F) Avail: NTIS HC $8.00 CSCL 22C

Analyses for Experiment M551 Metals Melting (MSFC), to be used for evaluating the performance of the Skylab corollary experiments under preflight, inflight, and post-flight conditions are presented. Experiment contingency plan workaround procedure and malfunction analyses are presented in order to assist in making the experiment operationally successful. Author.

N73-23861*# Teledyne Brown Engineering, Huntsville, Ala.
SKYLAB EXPERIMENT PERFORMANCE EVALUATION MANUAL. APPENDIX G: EXPERIMENT M552 EXOTHERMIC BRAZING (MSFC)
O. H. Thomas, Jr. May 1973 94 p refs
(Contract NAS8-21804)
(NASA-CR-61386-App-G) Avail: NTIS HC $6.75 CSCL 22C

Analyses for Experiment M552, Exothermic Brazing (MSFC), to be used for evaluating the performance of the Skylab corollary experiments under preflight, inflight, and post-flight conditions are presented. Experiment contingency plan workaround procedure and malfunction analyses are presented in order to assist in making the experiment operationally successful. Author

N73-23862*# Teledyne Brown Engineering, Huntsville, Ala.
SKYLAB EXPERIMENT PERFORMANCE EVALUATION MANUAL. APPENDIX H: EXPERIMENT M553 SPHERE FORMING (MSFC)
O. H. Thomas, Jr. May 1973 166 p refs
(Contract NAS8-21804)
(NASA-CR-61386-App-H) Avail: NTIS HC $10.50 CSCL 22C

Analyses for Experiment M553 Sphere Forming (MSFC), to be used for evaluating the performance of the Skylab corollary experiments under preflight, inflight, and post-flight conditions are presented. Experiment contingency plan workaround procedure and malfunction analyses are presented in order to assist in making the experiment operationally successful. Author

N73-23863*# Teledyne Brown Engineering, Huntsville, Ala.
SKYLAB EXPERIMENT PERFORMANCE EVALUATION MANUAL. APPENDIX J: EXPERIMENT M555 GALLIUM ARSENIDE SINGLE CRYSTAL GROWTH (MSFC)
M. S. Byers May 1973 87 p refs
(Contract NAS8-21804)
(NASA-CR-61386-App-J) Avail: NTIS HC $6.50 CSCL 22C

Analyses for Experiment M555, Gallium Arsenide Single Crystal Growth (MSFC), to be used for evaluating the performance of the Skylab corollary experiments under preflight, inflight, and post-flight conditions are presented. Experiment contingency plan workaround procedure and malfunction analyses are presented in order to assist in making the experiment operationally successful. Author

N73-23864*# Teledyne Brown Engineering, Huntsville, Ala.
SKYLAB EXPERIMENT PERFORMANCE EVALUATION MANUAL. APPENDIX S: EXPERIMENT T027 CONTAMINATION MEASUREMENT SAMPLE ARRAY (MSFC)
B. B. Tonetti Jan. 1973 74 p refs
(Contract NAS8-21804)
(NASA-CR-61386-App-S) Avail: NTIS HC $5.75 CSCL 22C

Analyses for Experiment T027, Contamination Measurement Sample Array (MSFC), to be used for evaluating the performance of the Skylab corrollary experiments under preflight, inflight, and post-flight conditions are presented. Experiment contingency plan workaround procedure and malfunction analyses are presented in order to assist in making the experiment operationally successful. Author

N73-23865*# Linguistic Systems, Inc., Cambridge, Mass.
K. E. TSIOLKOVSKIY AS A FILM CONSULTANT
A. S. Fedorov Washington NASA May 1973 12 p refs Transl. into ENGLISH from Priroda (USSR), no. 5, May 1970 p 117-120
(Contract NASw-2482)
(NASA-TT-F-14890) Avail: NTIS HC $3.00 CSCL 22B

The work is discussed of K. E. Tsiolkovskiy in the last years

of his life as a scientific consultant for the science fiction film The Space Trip. Attention is called to the prophetic nature of Tsiolkovskiy's comments and advice to the authors and directors of the film. Author

N73-23866*# Battelle Columbus Labs., Ohio.
DEGRADATION AND REUSE OF RADIATIVE THERMAL PROTECTION SYSTEM MATERIALS FOR THE SPACE SHUTTLE Interim Report, 26 Jun. 1970 - 26 Jul. 1971
E. S. Bartlett, D. J. Maykuth, I. M. Grinberg, and R. G. Luce 26 Jul. 1971 143 p
(NAS8-26205)
(NASA-CR-123587; IR-1) Avail: NTIS HC $9.25 CSCL 18F

Three silicide coated columbium alloys and two cobalt alloys were subjected to identical simulated reentry profiling exposures in both static (controlled vacuum leak) and dynamic (hypersonic plasma shear) environments. Primary emphasis in the columbium alloy evaluation was on the Cb752 and C129Y alloys with a lesser amount on FS85. Commercial silicide coatings of the R512E and VH109 formulations were used. The coated specimens were intentionally defected to provide the types of coating flaws that are expected in service. Temperatures were profiled up to peak temperatures of either 2350 F or 2500 F for 15 minutes in each cycle. Author

N73-23867*# Linguistic Systems, Inc., Cambridge, Mass.
SPACESHIPS
K. P. Feoktistov Washington NASA May 1973 18 p Transl. into ENGLISH from the book "Naselennyy Kosmos" Moscow, Nauka Press, 1972 p 216-228
(Contract NASw-2482)
(NASA-TT-F-14916) Avail: NTIS HC $3.00 CSCL 22B

The main problems of spaceflight as they relate to the earliest stages of manned spaceflight and to future spaceflight are discussed. Starting with an analysis of the problems encountered in making the first flights of Vostok and Mercury spacecraft, the article goes on to examine the problems encountered in the Apollo lunar flights and in future manned flights to Mars. Particular attention is given to the division of labor between automatic equipment and human crew. Author

N73-23868*# Techtran Corp., Silver Spring, Md.
ORBITAL STATIONS AND THE STUDY OF EARTH FROM SPACE
B. N. Petron Washington NASA May 1973 10 p Transl. into ENGLISH from Aviat. Kosmonavt. (Moscow), no. 4, 1971 p 32-33
(Contract NASw-2485)
(NASA-TT-F-13957) Avail: NTIS HC $3.00 CSCL 22B

Report is made of manned space stations in earth orbit to study natural resources, forecast weather, and to perform scientific experiments impossible under terrestrial conditions of atmosphere and gravitation. Human participation is considered indispensable in order to ensure appropriate and flexible response to unexpected and emergency situations. Author

N73-23869*# Kanner (Leo) Associates, Redwood City, Calif.
MARS 2 AND 3: ENGINEERING AND RESEARCH RESULTS
Rudolf Hofstaetter Washington NASA May 1973 41 p Transl. into ENGLISH from Flug-Rev. Int. (West Germany), Apr. 1973 p 25-28, 33-35
(Contract NASw-2481)
(NASA-TT-F-14914) Avail: NTIS HC $4.25 CSCL 22B

A summary is given of design features, events, experiments, and results of the Mars 2 and Mars 3 space probes, which were equipped to study the following: reflectivity of the Martian surface and atmosphere; surface temperature and electric permeability; subsurface temperature; composition, structure and density of the atmosphere; local ozone concentration; chemical composition of the ionosphere; water vapor and carbon dioxide content of the atmosphere; surface relief and features; cosmic radiation; interplanetary and Martian magnetic fields; ion levels in space; and radio-wave length radiation from the sun. A soft landing for the autonomous navigational system was unsuccessful for the Mars 2 lander; the Mars 3 lander was successful, but its television transmission lasted only 20 seconds before it malfunctioned. The units which entered Mars orbit continued producing data for about 8 1/2 months. Author

N73-23870*# Kanner (Leo) Associates, Redwood City, Calif.
VENUS 8: RESEARCH RESULTS
Rudolf Hofstaetter Washington NASA May 1973 13 p Transl. into ENGLISH from Flug-Rev. Int. (West Germany), Apr. 1973 p 35-36
(Contract NASw-2481)
(NASA-TT-F-14915) Avail: NTIS HC $3.00 CSCL 22B

Results of the Venus 8 probe were analyzed to determine the nature and composition of the planet's cloud cover, the percentage of sunlight which penetrates to the surface, and the physical and chemical properties of the surface. About 2/3 of the incident sunlight was found to be dispersed by the clouds and atmosphere. Temperature and pressure on the sunlight side were 470 c and 90 kg/sq cm. The concentration of water vapor near the cloud cover was 4 to 11 mg/1. Maximum nitrogen and inert gas concentration was 2; oxygen, 0.1% at altitudes of 46 km and 33 km. Peak wind values of 100 m/s were found at 45 km, dropping off to 2 m/s at 10 km and approximately 0 at the surface. The landing site soil had a strength of less than 1.5 g/sq cm; gamma radiation indicated that it contains 4% potassium, 0.0002% uranium and 0.00065% thorium. It is concluded that the surface consists of igneous rock. Author

N73-23871*# Chrysler Corp., New Orleans, La. Space Div.
SPACE SHUTTLE: DETERMINATION OF THE AERODYNAMIC INTERFERENCE BETWEEN THE SPACE SHUTTLE ORBITER, EXTERNAL TANK, AND SOLID ROCKET BOOSTER ON A 0.004 SCALE ASCENT CONFIGURATION
P. Ramsey (NASA. Johnson Space Center), R. Buchholz (Lockheed Missiles and Space Co.), E. Allen (North Am. Rockwell Corp.), and J. Dehart (NSI) Apr. 1973 926 p ref
(Contract NAS9-13247)
(NASA-CR-120060; DMS-DR-2010) Avail: NTIS HC $48.50 CSCL 22B

Wind tunnel tests were conducted to determine the aerodynamic interference between the space shuttle orbiter, external tank, and solid rocket booster on a 0.004 scale ascent configuration. Six component aerodynamic force and moment data were recorded over an angle of attack range from minus 10 to plus 10 degrees at zero degree sideslip. A sideslip range of minus 10 to plus 10 degrees at zero degree angle of attack was also tested. The Mach number range was varied from 0.6 to 4.96 with Reynolds number varying between 4.9 and 6.8 times one million per foot. Author

N73-23872*# Chrysler Corp., New Orleans, La. Space Div.
SPACE SHUTTLE: AN INVESTIGATION OF THE LOAD DISTRIBUTION OVER THE SRB AND EXTERNAL TANK OF A 0.004 SCALE MODEL OF THE 049 SPACE SHUTTLE LAUNCH CONFIGURATION
Robert A. Lott (Lockheed Missiles and Space Co.) and Paul Ramsey (NASA. Marshall Space Center) Apr. 1973 969 p ref
(Contract NAS8-4016)
(NASA-CR-120058; DMS-DR-1255) Avail: NTIS HC $50.50 CSCL 22B

A study was conducted in a trisonic wind tunnel to determine the load distribution over the external tank and solid rocket boosters of the space shuttle launch configuration. The external tank was sting-supported and the solid rocket boosters and orbiter were mounted directly on the external tank. The external tank was, instrumented with 152 pressure orifices and the solid rocket boosters contained 78 orifices. The pressure data were obtained for various combinations of the three geometric components as the gap size between the external tank and the solid rocket boosters, angle of attack, and angle of sideslip were varied. Mach numbers ranged from 0.8 to 1.96. Author

N73-23873*# McDonnell-Douglas Astronautics Co., St. Louis, Mo.
DESIGN, PROCESS DEVELOPMENT, MANUFACTURE, TEST AND EVALUATION OF BORON-ALUMINUM FOR SPACE SHUTTLE COMPONENTS Quarterly Report
R. A. Garrett 10 Mar. 1973 47 p refs
(Contract NAS8-27735)
(NASA-CR-124242; QR-4; MDC-E0783) Avail: NTIS HC $4.50 CSCL 22A

The development of sufficient technology to permit application

of boron-aluminum to space shuttle components is described. Specifically, report is made of the fabrication and testing of a 48 in. by 72 in. boron-aluminum compression panel capable of distributing a point load of 350,000 lbs. into a uniform running load within a peaking factor of 1.3 at a temperature of 600 F. In addition, small component testing was performed to verify the compression panel design. Author

N73-23874*# Ohio State Univ. Research Foundation, Columbus. Dept. of Geodetic Science.
GEODETIC SATELLITE OBSERVATIONS IN NORTH AMERICAN (SOLUTION NA-9)
Ivan I. Mueller, James P. Reilly, and Tomas Soler Sep. 1972 33 p refs
(Grant NGR-36-008-093; OSURF Proj. 2514)
(NASA-CR-131869; Rept-187) Avail: NTIS HC $3.75 CSCL 22C

A new detailed geoidal map with claimed accuracies of plus or minus 2 meters (on land), based on gravimetric and satellite data, was presented. With the new geoid and the orthometric heights given, more reliable height constraints were calculated and applied. The basic purpose of this experiment was to compute the new solution NA9 by defining the origin of the system, from the point of view of error propagation, in the most favorable position applying inner constraints and imposing new weighted height constraints to all of the stations. The major differences with respect to formerly published adjustments are presented. Author

N73-23875*# Pennsylvania State Univ., University Park. Dept. of Aerospace Engineering.
A MOVABLE MASS CONTROL SYSTEM TO DETUMBLE A DISABLED SPACE VEHICLE
Terry L. Edwards 19 Apr. 1973 91 p refs
(Grant NGR-39-009-210)
(NASA-CR-131867; Rept-73-5) Avail: NTIS HC $6.75 CSCL 22B

An internal autonomous control system to either completely detumble a spacecraft or lessen the tumbling motions until the rescue craft arrives is discussed. Such a device would become active upon loss of control. The development of a movable mass control system to convert the tumbling motions of a disabled vehicle into simple spin is presented. A simple spin state would greatly facilitate crew evacuation and final despinning by an external means. The system moves a control mass, according to a selected control law, in the acceleration environment created by the tumbling motion. By moving the mass properly, the rotational kinetic energy of the system may be increased or decreased creating simple spin states about the minimum or maximum moment of inertia axis, respectively. The control system is designed for the latter case due to its associated stability in the presence of perturbing forces. Author

N73-23876# AEG-Telefunken, Backnang (West Germany).
TELEVISION BROADCASTING SATELLITE: SUMMARY OF A STUDY
1972 91 p Prepared jointly with Dornier-Werke and ERNO Raumfahrttechnik
(Contract RV-II/1-V2/71-QH-00-10)
Avail: NTIS HC $6.75

The preliminary specifications for a radio-TV satellite covering the Federal Republic of Germany and all German-speaking west European areas, are summarized. To determine the telecommunication requirements for a satellite, detailed investigations, carried out for the terrestrial broadcast transmitter satellite home receiver link are discussed. Based on the results of the transmission path study, requirements for a national radio-TV satellite are detailed. The satellite configurations, payload, energy supply, attitude, orbit, and thermal control, planning and costs are discussed, and the satellite subsystems are analyzed. ESRO

N73-23877# Boeing Co., Seattle, Wash.
AERODYNAMIC STABILITY AND CONTROL, DATA, MODEL 844-2035
14 Feb. 1972 196 p refs
(Contract AF 33(600)-41517)
(AD-756854; D2-8174) Avail: NTIS CSCL 22/2

The aerodynamic stability and control characteristics of the 844-2035 Dyna Soar glider are presented. These data are based on wind tunnel tests, where data are available. Where not available, theoretical estimates have been made for the vehicle characteristics. This is the interim glider configuration. Some vehicle characteristics peculiar to this configuration are not satisfactory and will be modified for the final configuration. The data presented will be revised as additional wind tunnel data are received and better estimates of the vehicle characteristics are made. GRA

N73-23878# Polytechnic Inst. of Brooklyn, Farmingdale, N.Y. Dept. of Aerospace Engineering and Applied Mechanics.
PERFORMANCE CHARACTERISTICS OF VEHICLES TRAVELLING IN NEAR-EARTH ORBITS AT SUPERSATELLITE VELOCITIES
M. H. Bloom and A. R. Krenkel Feb. 1972 57 p refs
(Contract F44620-71-C-0008; AF Proj. 9781)
(AD-757522; PIBAL-72-7; AFOSR-73-0504TR) Avail: NTIS CSCL 22/3

The performance of several types of vehicles which have the capability of traversing near-earth circular orbits at supersatellite velocities was investigated. These vehicles use a normal thrust component or negative lift to maintain the circular orbits. Four basic types of vehicles were considered: (a) constant thrust rocket; (b) perpendicular; modulating thrust rocket; (c) inverted glider; and (d) inverted cruise vehicle. Although no particular missions for such flights were envisaged, it is conceivable that supersatellite vehicles (SSV) could be used for reconnaissance, orbital rescue missions, or delivery of high priority payloads in both military and non-military contexts. Specific impulse values of 300 and 600 seconds were studied for all powered stages. (Author Modified Abstract) GRA

N73-23879*# ARO, Inc., Arnold Air Force Station, Tenn.
PRESSURE TEST ON THE VIKING LANDER CAPSULE AT MACH NUMBER 10 Final Report
E. C. Knox and J. I. Best, Jr. AEDC Dec. 1972 34 p Sponsored by NASA and AEDC
(ARO Proj. VA026)
(NASA-CR-131983; AD-753073; AEDC-TR-72-185; ARO-VKF-TR-72-158) Avail: NTIS HC $3.75 CSCL 22/2

Surface pressure tests were made on a scale model of the Viking Lander Capsule at Mach number 10 and Reynolds numbers, based on the model aeroshell radius. Angle of attack was varied from -26 to 26 deg with yaw angles of -5 and -10 included at the capsule estimated trim angle of attack of 11.2 deg. Results show the effect of protuberances representing a camera bump, an antenna, a reaction control system, and other appendages on the base cover pressure distribution. Comparisons with data from another test facility are also presented. Author (GRA)

N73-23880# Ballistic Research Labs., Aberdeen Proving Ground, Md.
A PRECISION YAWSONDE CALIBRATION TECHNIQUE
Wallace H. Clay Jan. 1973 44 p refs
(DA Proj. 1T0-61102-A-33D)
(AD-758158; BRL-MR-2263) Avail: NTIS CSCL 19/7

A technique has been developed for the accurate calibration of yawsondes of the Harry Diamond Laboratory type to provide a calibration accurate to within 0.1 degree. The current system can be applied to calibration of yawsonde made at the Ballistic Research Laboratories with the same accuracy as the HDL type. Author (GRA)

N73-23881# Advisory Group for Aerospace Research and Development, Paris (France).
AUTOMATION IN MANNED AEROSPACE SYSTEMS
Mar. 1973 322 p refs In ENGLISH and partly in FRENCH Presented at 24th Tech. Meeting of the Avionics Panel of AGARD, Dayton, Ohio, 16-19 Oct. 1972
(AGARD-CP-114) Avail: NTIS HC $18.25

Functional analyses of manned aerospace systems for the design of automatic avionic equipment are reported. Onboard computer capabilities to perform decision making functions, adaptice control, malfunction detection and compensation real-time control are considered. For individual titles, see N73-23882 through N73-23905.

N73-23882 Massachusetts Inst. of Tech., Cambridge.
MAN'S ROLE IN INTEGRATED CONTROL AND INFORMATION MANAGEMENT SYSTEMS c08
J. L. Nevins and I. S. Johnson *In* AGARD Automation in Manned Aerospace Systems Mar. 1973 7 p refs (For availability see N73-23881 14-31)

An information processing and data management system is reported that relieves man's role in such tasks as pre-flight subsystem checkout and periodic system status checks. The prototype generalized display and command technique outlined features a pushplate interactive control scheme with graphic display in connection with an airborne computer. G.G.

N73-23883 Office National d'Etudes et de Recherches Aerospatiales, Paris (France).
GENERAL GUIDELINE FOR THE DESIGN OF MANNED AEROSPACE VEHICLES
Jean-Claude Wanner *In* AGARD Automation in Manned Aerospace Systems Mar. 1973 8 p refs (For availability see N73-23881 14-31)

The Franco-British airworthiness authorities reviewed the set of technical specifications required for Concorde in order to insure the safety of the missions of this new transport aircraft. In order to guide the definition of these now regulations, a theoretical method was developed for evaluating the reliability of the missions of manned aerospace vehicles. This method is based on an investigation of the way of occurrence of accidents. It has been seen that an accident is due to a set of incidents which can be classified into only three different types. The study of each type of incident, the probability of occurrence which has to be reduced in order to increase the safety, is very useful to help the designer of a new project to choose between possible solutions, taking into account the reliability of the systems, the possible human errors and the flight conditions. Author

N73-23884 Grumman Aerospace Corp., Bethpage, N.Y.
THE INFLUENCE OF COST AND TECHNICAL RISK ON THE DESIGN OF THE AVIONICS SYSTEM FOR THE SPACE SHUTTLE
Howard T. Wright *In* AGARD Automation in Manned Aerospace Systems Mar. 1973 9 p (For availability see N73-23881 14-31)

The evolution of the Space Shuttle Program, from its inception to the release of the request for proposal in April of 1972, has been influenced primarily by cost considerations. Various configurations were studied, and cost pre-flights were traded against developmental cost. These studies indicated operational costs between 4.5 million and 15.8 million dollars per flight. The baseline configuration was based on the best competition between development and operational cost considerations. The configuration selected was a small orbiter vehicle with an external hydrogen and oxygen tank and two solid rocket engines. This configuration results in operational cost per flight of approximately 11 million dollars. Author

N73-23885 Northrop Corp., Palos Verdes Peninsula, Calif.
AUTOMATIC ACQUISITION AND TRACKING METHODS EMPLOYED IN THE JOINT SERVICES IN-FLIGHT DATA TRANSMISSION SYSTEM (JIFDATS) c07
T. N. Leiboff *In* AGARD Automation in Manned Aerospace Systems Mar. 1973 21 p (For availability see N73-23881 14-31)

JIFDATS is an all-weather, day-night, multi-sensor, in-flight data transmission system designed for use by all the military services. The normal operating mode for JIFDATS is automatic. Except for the usual checkout, servicing and maintenance activities in which personnel take a large part, the only need for personnel functions is to establish the proper conditions for system operation, turn on the system, and monitor the operation to assure continuity of data transmission. In each case though, there is a manual back-up mode for bypassing the automatic features of acquisition and tracking. A scenario of a typical tactical reconnaissance mission is presented showing the various steps taken by the operator in the sensor aircraft, the operator in the relay aircraft, and personnel at the surface terminal during each phase of the mission. It is shown how the relay aircraft automatically acquires the sensor aircraft which is transmitting a low bandwidth signal on an omni-directional antenna, while it rotates its high-gain narrow beam directional antenna. The sensor aircraft locks on to the relay while the relay and ground terminals acquire and track. Author

N73-23886 Consiglio Nazionale delle Ricerche, Genoa (Italy).
DETERMINATION OF AN OPTIMAL TRAJECTORY IN THE PRESENCE OF RISK c30
A. Tiano, P. Dagnino, and M. Piattelli *In* AGARD Automation in Manned Aerospace Systems Mar. 1973 19 p refs (For availability see N73-23881 14-31)

A controlled dynamic system is considered that displaces within an assigned space, where r moving targets are contained. An optimal control sequence transfers the system from an initial point to a preset terminal point so that the optimal trajectory is the one which, complying with some safety constraints imposed by the targets, minimizes a given cost function. Assuming that the system may be supplied with periodical information about the motion of the targets, a numerical algorithm utilizing a dynamic programming procedure is determined. This procedure is applied to two practical problems: (1) Marine anticollision aided by computerized radar systems in the presence of N targets; and (2) determination of an optimal evasion strategy in the presence of cyclonic disturbances. Author

N73-23887 North American Rockwell Corp., Downey, Calif. Space Div.
SPACE STATION INFORMATION SYSTEM REQUIREMENTS: A CASE HISTORY OF MAN-MACHINE SYSTEM DEFINITION
C. R. Gerber *In* AGARD Automation in Manned Aerospace Systems Mar. 1973 8 p (For availability see N73-23881 14-31)

The NASA space station definition studies incorporate a multiplicity of automated supporting functions to enhance the useful work capability of very few men. The SS information system is the means by which the men interface with all subsystems, space experiments, other vehicles, ground support facilities and personnel. It is therefore a driver in determining what program and mission objectives can be satisfied. The study resulted in the definition of an information subsystem consisting of a unique combination of multi-processing computation, internal data distribution via a digital data bus, crew interfacing via a set of multi-purpose display and control consoles, and external data distribution via a combination of VHF, S, and K band RF links. Author

N73-23888* Internaticnal Business Machines Corp., Houston, Tex. Federal Systems Div.
AUTOMATED TECHNIQUES FOR SPACECRAFT MONITORING
H. Richard Segnar *In* AGARD Automation in Manned Aerospace Systems Feb. 1972 12 p refs Sponsored by NASA (For availability see N73-23881 14-31)
CSCL 22B

The feasibility of implementing automated spacecraft monitoring depends on four factors: sufficient computer resources, suitable monitoring function definitions, adequate spacecraft data, and effective and economical test systems. The advantages of automated monitoring lie in the decision-making speed of the computer and the continuous monitoring coverage provided by an automated monitoring program. Use of these advantages introduces a new concept of spacecraft monitoring in which system specialists, ground based or onboard, freed from routine and tedious monitoring, could devote their expertise to unprogrammed or contingency situations. Author

N73-23889 Saab Aircraft Co., Linkoping (Sweden). Systems and Avionics Dept.
SOME DEVELOPMENT TRENDS IN THE INTEGRATION OF ELECTRONIC SYSTEMS IN THE SWEDISH AIRCRAFT 37 VIGGEN c02
Bengt Sjoebert *In* AGARD Automation in Manned Aerospace Systems Mar. 1973 8 p (For availability see N73-23881 14-31)

The Swedish 37 VIGGEN aircraft is being developed in several versions and the electronic systems of the attack version and the later fighter version are compared and some development trends are discussed. An increased role of the central computer

is recognized as well as a trend towards digitalization of several subsystems. Author

N73-23890 Aeritalia, Turin (Italy).
MULTILOOP ATTITUDE CONTROL SYSTEM FOR A SATELLITE WITH FLEXIBLE BOOMS
R. DiLorenzo and E. DeBernardis *In* AGARD Automation in Manned Aerospace Systems Mar. 1973 13 p refs (For availability see N73-23881 14-31)

A class of momentum exchange devices control configurations has been considered, namely that which provide a momentum quite larger along one body axes rather than along the other ones. The general equations of a satellite controlled in such a way have been used, in order to provide a control system which is independent from the particular devices used; these equations have been modified in order to take into account that the satellite has a couple of flexible booms. A simple multiloop controller has been designed for such equations, and it is shown that to adapt it to each particular actuators configuration it is only necessary to design three very conventional inner control loops. Finally, a simulation of the full flexible systems has been made, using FORTRAN 5, with reasonable numerical values of the satellite dynamics parameters, where it is shown that a controller designed considering rigid the whole satellite results either in instability or very degraded pointing accuracy. Author

N73-23891* National Aeronautics and Space Administration. Marshall Space Flight Center, Huntsville, Ala.
OPTIMUM SPACEBORNE COMPUTER SYSTEM DESIGN BY SIMULATION c08
T. Williams (Computer Sci. Corp., Huntsville, Ala.), H. Kerner, J. E. Weatherbee (Computer Sci. Corp., Huntsville, Ala.), D. S. Taylor (Computer Sci. Corp., Huntsville, Ala.), and B. Hodges *In* AGARD Automation in Manned Aerospace Systems Mar. 1973 12 p refs (For availability see N73-23881 14-31)
CSCL 09B

A deterministic simulator is described which models the Automatically Reconfigurable Modular Multiprocessor System (ARMMS), a candidate computer system for future manned and unmanned space missions. Its use as a tool to study and determine the minimum computer system configuration necessary to satisfy the on-board computational requirements of a typical mission is presented. The paper describes how the computer system configuration is determined in order to satisfy the data processing demand of the various shuttle booster subsytems. The configuration which is developed as a result of studies with the simulator is optimal with respect to the efficient use of computer system resources. Author

N73-23892 Consiglio Nazionale della Ricerche, Pisa (Italy). Ist. di Elaborazione dell Informazione.
EXTENSION OF SIMULA 67 FOR PROCESS CONTROL c08
Juliusz H. Kardasz *In* AGARD Automation in Manned Aerospace Systems Mar. 1973 13 p refs (For availability see N73-23881 14-31)
Copyright.

An extension of SIMULA 67 towards process control is reported. The extension is prepared with an idea of using it to control large systems of interconnected devices where the necessity for real time simulation arises, in order to define a future behaviour of the system. This extension combines both characteristics of procedural and fill-in-the-blank (format oriented) languages. The programming requirements for process control applications are discussed and a comparison is made between some algorithmic languages with respect to the degrees in which they meet these requirements. This discussion shows that SIMULA 67 requires the introduction of less new concepts than other languages in order to be extended for process control. These new concepts include first of all the interface with a process which is introduced by an external class to be implementation defined. A procedural language is used for constructing the body of the system, composed of procedures and classes. Author

N73-23893* National Aeronautics and Space Administration. Lyndon B. Johnson Space Center, Houston, Tex.
SYSTEMS PERFORMANCE MONITORING FOR ADVANCED MANNED SPACECRAFT
T. V. Chambers *In* AGARD Automation in Manned Aerospace Systems Mar. 1973 16 p refs (For availability see N73-23881 14-31)
CSCL 22B

Optimum system mechanizations for advanced manned spacecraft are considered. Several studies have proposed automation of the onboard system management task, with functions such as system status monitoring, configuration management, and redundancy management being accomplished under computer control. An experimental system was used in the laboratory to investigate hardware and software requirements for accomplishing these onboard system management functions. A performance monitor system is proposed for the space shuttle. This system provides support to the flight crew in the management of all onboard systems but does not perform critical switching functions during the flight phase. Author

N73-23894 Selenia S.p.A., Rome (Italy).
A GENERAL PURPOSE COMPUTER FOR SPACEBORNE APPLICATIONS c08
S. Boesso and R. Camberale *In* AGARD Automation in Manned Aerospace Systems Mar. 1973 18 p (For availability see N73-23881 14-31)

A modular expandable computer system is studied for a wide range of possible space missions. The main goals in designing the computer have been maximum flexibility and reliability, minimum weight and power consumption and growth capability to fit future mission requirements. The study resulted in a stored program, 16 bit, parallel machine, with microprogrammed control which allows full arithmetic and logic capability. Input-output includes program-controlled and direct-memory-access channels. The main points of trade-off for system design are presented and a description of the basic computer units at the functional block level is given. Author

N73-23895 Societe Nationale Industrielle Aerospatiale, Paris (France).
INERTIALESS FLIGHT METHODS [PROCEDE DE SURVOL NON INERTIEL] c21
P. J. Bigeon, J. Langlois, and R. Berrqir *In* AGARD Automation in Manned Aerospace Systems Mar. 1973 19 p In FRENCH (For availability see N73-23881 14-31)

An automatic inertialess flight control and guidance system is reported that determines aircraft position by precisely calculating actual flight course deviation for telemetric guidance correction. An onboard computer processes data from a platform containing directional and vertical gyroscopes, from an automatic pilot, and from an atmospheric pressure sensor. Transl. by G.G.

N73-23896 Royal Aircraft Establishment, Farnborough (England).
THE EXPERIMENTAL EVALUATION OF AUTOMATED NAVIGATION SYSTEMS c21
J. G. Carr *In* AGARD Automation in Manned Aerospace Systems Mar. 1973 13 p (For availability see N73-23881 14-31)

Certain aspects of automated avionics systems which are being examined in the RAE Comet exercise are described. The emphasis is on navigation systems and includes the work on digital computers and on-board digital communication techniques, software developments including the use of high level programming languages, and the use of computer controlled electronic displays. The laboratory work using simulated navigation sensor inputs into an experimental system comprising a digital computer and electronic displays is described. A Comet 4 aircraft has been re-equipped as a flying laboratory for this work. The installation in the cabin of the aircraft and some of the current experimental investigations are described. The cockpit of the Comet has also been modified by the addition of experimental electronic displays to the second pilot's instrument panel. Author

N73-23897 Systems Control, Inc., Palo Alto, Calif.
CURRENT STATUS OF MODELS FOR THE HUMAN OPERATOR AS A CONTROLLER AND DECISION MAKER IN MANNED AEROSPACE SYSTEMS c05
A. V. Phatak and D. L. Kleinman *In* AGARD Automation in Manned Aerospace Systems Mar. 1973 10 p refs (For availability see N73-23881 14-31)

Mathematical models of human decision processes and adaptive behavior have been proposed for specific control situations. Accepted techniques and models for analyzing and predicting human performance in complex multi-control and multi-display situations commonly found in aerospace system are surveyed. The models have been developed or proposed for the related human functions of information processing, decision making and control. The relative advantages, disadvantages and limitations of each of the modeling schemes are discussed and prospects for mechanizing all or part of the decision functions performed by human operators are considered; specific examples being in the automation of human failure detection and adaptation to sudden changes in the system operating conditions. Author

N73-23898 Royal Aircraft Establishment, Bedford (England).
MANUAL LANDING IN FOG c02
R. R. Newbery *In* AGARD Automation in Manned Aerospace Systems Mar. 1973 19 p refs (For availability see N73-23881 14-31)

The results of 18 fog flying sorties using a Category II operation terminated by a manual landing have been analyzed in an attempt to learn more about the pilot's capabilities in this environment. Measurements were made to correlate the pilot's decision making process with actual fog structures in real operation. A wide variety of fog structure and visual sequences are illustrated which demonstrate the lack of relationship between the visual segment at high decision heights, the height at which visual contact is first made and the runway visual range measurement. The pilots felt that Category II operation was straightforward provided that good quality approach performance, strict crew drills a accurate RVR reporting to give warning of shallow or changing fog conditions along the runway, were maintained. Author

N73-23899 Aerospace Medical Research Labs., Wright-Patterson AFB, Ohio.
MONTE CARLO SIMULATION OF DEGRADED MAN-MACHINE PERFORMANCE c05
Gerald P. Chubb *In* AGARD Automation in Manned Aerospace Systems Mar. 1973 11 p refs (For availability see N73-23881 14-31)

System vulnerability is a function of both human and hardware vulnerabilities to anticipated threat environments. The feasibility of considering the interaction of man and machine degradation under nuclear attack conditions has recently been demonstrated. It appears that the technique may be useful in identifying certain situations where automation may be particularly useful under these attack conditions, although the requirement is not obvious from analyses of system performance under nominal operating conditions. The approach taken appears generalizable to other degradation conditions, such as inflight malfunctions and conventional weapons battle damage. Given suggested changes in man-machine task sequencing, the model can aid in assessing how these changes may affect selected systems effectiveness measures. A number of refinements and extensions to the current capabilities of this model are envisioned and briefly discussed. Author

N73-23900 Marconi-Elliott Avionic Systems Ltd., Rochester (England).
DEVELOPMENTS IN AIRCRAFT DIGITAL SYSTEMS c08
R. Ruggles and E. M. Scott *In* AGARD Automation in Manned Aerospace Systems Mar. 1973 11 p (For availability see N73-23881 14-31)

The effects of the relationship between user need and technological capability are considered for flight control as opposed to navigation and some physical characteristics of current digital autopilots are given. The functional division and integration of avionic subsystems are considered and it is concluded that integration in the form of loosely federated groups of related systems is preferred to the centralized computer complex in spite of its apparent conceptual simplicity. The concept of task oriented computers is discussed and the main parameters of some existing examples are given. Some details of the architecture, software and hardware for this type of computer are given. An example of the application to automatic flight control with a requirement for a fail operative capability is given and the problem of dealing with tolerances between operating lanes is briefly discussed. Author

N73-23901 Hawker Siddeley Aviation, Ltd., Hatfield (England).
HUMAN FACTORS IN LOW WEATHER OPERATION OF TRANSPORT AIRCRAFT c05
J. W. Wilson *In* AGARD Automation in Manned Aerospace Systems Mar. 1973 5 p (For availability see N73-23881 14-31)

Practical experience gained during the manufacturer's flight development testing and airline in-service operation of a failure-survival Category 3 automatic landing system is reviewed for indications of the extent to which human factors have affected the design of the system and the techniques used by the airline in order to reach the very high safety levels that are necessary. The important factors influencing the complexity of the task are: (1) Provision of adequate monitoring devices located in the optimum area of each crew member's primary visual scan, to enable the pilot to keep ahead of the operation of the automatic control systems; (2) application of identical procedures for use in Category 1, 2 or 3 weather; (3) design of the system and development of procedures such that the maximum number of manual and automatic functions that require action, checking or monitoring can be completed before the final stage of the approach to land; and (4) the decision to land should be made as low as possible, compatible with a go-around performance which will not normally result in touchdown. Author

N73-23902 Air Force Systems Command, Wright-Patterson AFB, Ohio. Airborne Computer Engineering Branch.
AVIONIC SYSTEMS INTEGRATION USING DIGITAL COMPUTERS c14
Erwin C. Gangl *In* AGARD Automation in Manned Aerospace Systems Mar. 1973 5 p (For availability see N73-23881 14-31)

Present weapon systems use a multiplicity of signal formats and transmission techniques for information transfer within an integrated avionics system. The implementation of a serial digital data bus as the primary means of functionally communicating and interconnecting the various equipments is described. If a system is logically partitioned to the data it supplies, requires or processes, then with a flexibly designed digital data bus and standard interfaces, it can easily be integrated through the computer software. Modification of redesign of the multiplexed data bus concept is a matter of reconfiguration of the building blocks, adding and deleting as required and then changing the software to reintegrate the new configuration, saving the costly rewiring and redesigning of the computer converter box. The computer is now a separate line replaceable unit, not subject to obsolescence due to systems modifications. Author

N73-23903 Smiths Industries, Ltd., Cheltenham (England). Aviation Div.
THE EXPONENTIAL PROBABILITY DISTRIBUTION AND ITS USE IN ASSESSING THE PERFORMANCE STATISTICS OF AEROSPACE SYSTEMS
D. A. Lloyd *In* AGARD Automation in Manned Aerospace Systems Mar. 1973 31 p refs (For availability see N73-23881 14-31)

The statistics of the output state variables of automatic aerospace systems are of considerable interest and of wide application, particularly in the case of manned systems. The paper shows that the exponential probability distribution can be used as an approximation to the distributions of the output state variables of practical aerospace systems for a wide range of practical situations. The use of the exponential distribution as a practical mathematical tool is suggested in the assessment of some of the performance statistics of aerospace systems, both for preliminary calculations and for final calculations involving the extrapolation of test results. Author

N73-23904* National Aeronautics and Space Administration, Washington, D.C.
POTENTIAL TELEOPERATOR APPLICATIONS IN MANNED AEROSPACE SYSTEMS c05
Edwin G. Johnsen *In* AGARD Automation in Manned Aerospace Systems Mar. 1973 4 p refs (For availability see N73-23881 14-31)

CSCL 05H

The trend of teleoperator development is toward digital computer controlled systems which utilize local sensor-computer-actuator loops to avoid obstacles and to sense manipulator grip-and-slip. The potential applications of advanced teleoperator technology to manned aerospace systems include long manipulator booms to be mounted on the shuttle. These can transfer cargo from the space shuttle and can acquire and retrieve objects in space. Free-flying teleoperators capable of acquiring, inspecting, repairing or refurbishing satellites in orbit are another space application. Another potential application of teleoperator technology is the concept of using an anthropomorphous teleoperator in lieu of man to control aircraft or spacecraft normally controlled by a human pilot. Author

N73-23905 Boeing Co., Seattle, Wash.
MAN-MACHINE CONSIDERATIONS IN THE DEVELOPMENT OF A COCKPIT FOR AN ADVANCED TACTICAL FIGHTER c05
S. Joel Premselaar and D. E. Frearson (AFFDL) *In* AGARD Automation in Manned Aerospace Systems Mar. 1973 20 p (For availability see N73-23881 14-31)

A revolutionary cockpit concept for a 1975-85 one-man, multi-mission fighter aircraft completed an initial simulation phase recently. The design goal of this concept is to achieve a one-man workload level by presenting the pilot only the information necessary for the particular mission segment he is performing, and yet provide maximum flexibility in terms of pilot options. Key elements of the cockpit design are: Multiple, time-shared electronic displays; keyboard and voice command computer input devices; wrap-around cockpit arrangement for ease of access to the control-display devices; an integrated total energy command; and a system of dependent automation that permits reduced pilot workload during anomalies. The simulator provides a one-of-a-kind capability for examination of the flight deck design issues involved in tailoring the power and flexibility of the computer to the capabilities and limitations of the human pilot in the performance of his mission. Author

N73-23601* National Aeronautics and Space Administration, Washington, D.C.
THE ENVIRONMENT AND MATERIALS FOR GLIDE REENTRY VEHICLES
G. C. Deutsch *In* AGARD High Temp. Corrosion of Aerospace Alloys Mar. 1973 p 43-59 (For availability see N73-23597 14-17)
CSCL 22C

32 STRUCTURAL MECHANICS

Includes structural element design and weight analysis; fatigue; thermal stress; impact phenomena; vibration; flutter; inflatable structures; and structural tests. For related information see also: 17 Materials, Metallic; and 18 Materials, Nonmetallic.

N73-23906 Engineering Sciences Data Unit, London (England).
STIFFNESS OF FLAT STRIPS IN COMPRESSION UNDER SINUSOIDALLY DISTRIBUTED BENDING COUPLES AT THEIR EDGES (MODE 1, LOADED EDGE SIMPLY SUPPORTED, REMOTE EDGE FREE, EXTENDED RANGE)
Jul. 1972 3 p refs
(ESDU-05.01.30-Amend-A) Copyright. Avail: Issuing Activity

The stiffness studies reported are appropriate to the case of an infinitely long thin flat strip simply-supported at one edge, completely free of restraint at the other, and subjected to a longitudinal compressive stress distributed uniformly across its cross section. The simply-supported edge is loaded by a bending couple distributed sinusoidally along the length, and the stiffnesses represented are those corresponding to a loading of this type. The cross section of the strip is bent by this couple and, consequently, the edge rotates around the edge line which is fixed in space. Author

N73-23907 Engineering Sciences Data Unit, London (England).
SANDWICH PANELS WITH CORRUGATED CORE AND EQUAL FACE PLATES TRANSVERSE SHEAR STIFFNESS
Dec. 1969 3 p refs
(ESDU-07.03.01) Copyright. Avail: Issuing Activity

Elastic constants are used to find the transverse stiffness of a corrugated core sandwich plate. The effects of core design and core attachments to the plate on shear stiffness are discussed. E.H.W.

N73-23908# Hong Kong Univ. Dept. of Civil Engineering.
STABILITY ANALYSIS OF MULTILAYER SANDWICH STRUCTURES
T. P. Khatua and Y. K. Cheung 16 Aug. 1972 45 p refs Backup document for AIAA Synoptic scheduled for publication in AIAA Journal in Sep. 1973 Sponsored by Natl. Res. Council of Can. Prepared in cooperation with Calgary Univ.
Avail: NTIS HC $4.25

Stability matrices of displacement type for multilayer sandwich beam, rectangular and triangular plate element with n stiff layers and n minus 1 weak cores are presented. The elements are applied to several standard stability problems and good accuracy is demonstrated. The complex problem of rectangular plate with circular hole is included to show the versatility of the method. Author

N73-23909*# Tennessee Technological Univ., Cookeville. Dept. of Engineering Science.
BUMPER-PROTECTED LAMINATED SPACECRAFT MAINWALLS
Ray Kinslow Washington NASA May 1973 63 p refs
(Contract NAS1-10967)
(NASA-CR-2262) Avail: NTIS HC $3.00 CSCL 22B

A study was made of the meteoroid impact resistance of bumper-protected mainwalls of both solid aluminum and polycarbonate-aluminum laminates. Semi-empirical models of the debris cloud and stress waves were formulated. Results indicated that a laminated mainwall affords greater impact resistance than a solid aluminum mainwall of the same weight. Author

N73-23910*# Grumman Aerospace Corp., Bethpage, N.Y.
EXPERIMENTAL INVESTIGATION OF ORTHOTROPIC PANEL FLUTTER AT ARBITRARY YAW ANGLES, AND COMPARISON WITH THEORY
Peter Shyprykevich Washington NASA May 1973 35 p refs
(Contract NAS1-10635)
(NASA-CR-2265) Avail: NTIS HC $3.00 CSCL 20K

Flutter characteristics for yaw angles between 15 deg and 90 deg were determined experimentally for two types of corrugation-stiffened panels: those with weak twisting stiffness and those with strong twisting stiffness. By mounting the panels on a remotely controlled turntable, good definition of the flutter boundaries was obtained by rotating the panels into and out of flutter. Flutter tests were conducted at M = 2 and M = 1.6. Before testing, vibration tests and analyses were also performed. The experimental flutter data is compared with flutter theory for orthotropic panels utilizing quasi-steady aerodynamics. Five different corrugated panels were tested consisting of one single skin panel having a length-to-width ratio of 5 on clamped supports and four different square double skin panels on discrete flexible supports. The investigation indicated that flutter speed for corrugated panels is highly dependent on yaw angle. Reasonable flutter correlation between analysis and test was obtained for moderate yaw angles, but extreme sensitivity to structural parameters made the correlation at large yaw angles uncertain. Author

N73-23911# Institute TNO for Mechanical Constructions, Delft (Netherlands).
OPTIMIZATION OF STRUCTURAL DESIGN 1
P. Meijers Jan. 1973 23 p refs
(Rept-10432) Avail: NTIS HC $3.25

A survey of literature on optimal structural design is presented. The method of fully stressed design is discussed. In principle the structure is optimized such that all members are subjected to the maximum allowable stress for at least one loading condition. Linear programming problems are considered to show that the object function and the constraints are linear functions of the

design variables. The penalty function approach for general nonlinear programming problems is developed. Author

N73-23912# Lockheed Missiles and Space Co., Palo Alto, Calif.
DIFFERENTIAL EQUATIONS OF THE THERMOELASTIC STATE OF SHELLS UNDER THERMAL IMPACT ON THE SURFACE
E. A. Gotsuliak, V. I. Guliaev, and V. K. Chibiriakov 1973 9 p refs Transl. into ENGLISH from Prikl. Mekh. (Kiev), v. 9, no. 2, 1973 p 32-41
Avail: NTIS HC $3.00; National Translations Center, John Crerar Library, Chicago, Illinois 60616

A numerical analysis of the thermoelastic state of shells under thermal impact on the surface is presented. Differential equations of shell motion under conditions of rapid temperature change are determined by a projection method of reducing the three dimensional problem of thermoelastic shell dynamics to a two dimensional problem. The equations of thermal and force equilibrium of an element of the elastic medium in the presence of a connection between the temperature and strain fields in an arbitrary coordinate system are developed. Mathematical models are included to support the theoretical considerations. Author

N73-23913# Lockheed Missiles and Space Co., Palo Alto, Calif.
ON THE QUESTION OF CONSTRUCTING TRANSFER FUNCTIONS IN PROBLEMS OF WEAK SHOCK INTERACTIONS WITH CYLINDRICAL AND SPHERICAL SURFACES
V. D. Kubenko 1973 5 p refs Transl. into ENGLISH from Dokl. Akad. Nauk SSSR (Moscow), Ser. A, no. 2, 1973 p 148-152
Avail: NTIS HC $3.00; National Translations Center, John Crerar Library, Chicago, Illinois 60616

Beginning with a formula for determining the potential of the reflected wave in nonstationary wave interaction with a solid, an equation is obtained for the reflected wave potential on the body surface in terms of the incident wave potential. J.M.M.

N73-23914*# McDonnell-Douglas Astronautics Co., Huntington Beach, Calif.
STUDY OF AN EXPERIMENTAL TECHNIQUE FOR APPLICATION TO STRUCTURAL DYNAMIC PROBLEMS
R. F. Snell Mar. 1973 74 p refs
(Contract NAS9-12873)
(NASA-CR-128911; MDAC-G4157) Avail: NTIS HC $5.75 CSCL 20K

An experimental program was conducted to determine the feasibility of using subscale plastic models to determine the response of full-scale aerospace structural components to impulsive, pyrotechnic loadings. A monocoque cylinder was impulsively loaded around the circumference of one end, causing a compressive stress wave to propagate in the axial direction. The resulting structural responses of two configurations of the cylinder (with and without a cutout) were recorded by photoelasticity, strain gages, and accelerometers. A maximum dynamic stress concentration was photoelastically determined and the accelerations calculated from strain-gage data were in good agreement with those recorded by accelerometers. It is concluded that reliable, quantitative structural response data can be obtained by the experimental techniques described in this report. Author

N73-23915*# Virginia Polytechnic Inst., Blacksburg. Dept. of Engineering Science and Mechanics.
STRESS INTENSITY FACTORS FOR LONG, DEEP SURFACE FLAWS IN PLATES UNDER EXTENSIONAL FIELDS
A. E. Harms and C. W. Smith Feb. 1973 41 p refs
(Grant NGR-47-004-076)
(NASA-CR-132015; VPI-E-73-6) Avail: NTIS HC $4.25 CSCL 20K

Using a singular solution for a part circular crack, a Taylor Series Correction Method (TSCM) was verified for extracting stress intensity factors from photoelastic data. Photoelastic experiments were then conducted on plates with part circular and flat bottomed cracks for flaw depth to thickness ratios of 0.25, 0.50 and 0.75 and for equivalent flaw depth to equivalent ellipse length values ranging from 0.066 to 0.319. Experimental results agreed well with the Smith theory but indicated that the use of the "equivalent" semi-elliptical flaw results was not valid for a/2c less than 0.20. Best overall agreement for the moderate (a/t approximately 0.5) to deep flaws (a/t approximatelly 0.75) and a/2c greater than 0.15 was found with a semi-empirical theory, when compared on the basis of equivalent flaw depth and area. Author

N73-23916# National Aerospace Lab., Amsterdam (Netherlands).
SOME CONTRIBUTIONS OF ELECTRON FRACTOGRAPHY TO THE THEORY OF FRACTURE
D. Broek [1972] 100 p refs
(NLR-TR-72029-U) Avail: NTIS HC $7.00

A survey of the results of five years electron fractography research is made. The survey concentrated largely on fatigue and ductile fracture, with special emphasis on aluminum alloys. Work was done on stress corrosion and cleavage fracture. Some of the fractographs were obtained with electron microscopes equipped with a goniometer stage. ESRO

N73-23917# National Aerospace Lab., Amsterdam (Netherlands). Div. of Structures and Materials.
HYDROGEN EMBRITTLEMENT OF THE CIRCUMFERENTIALLY NOTCHED ROUND SPECIMEN
H. P. VanLeeuwen Aug. 1972 65 p refs
(NLR-TR-72113-U) Avail: NTIS HC $5.25

Delayed failure test results for hydrogenated and cadmium plated specimens were analyzed. It was found that in a nonhomogeneous stress field the hydrogen diffuses to and accumulates at the elastic plastic interface. The local hydrogen concentration tends to reach a maximum which is a function of the overall hydrogen content and the materials yield stress. Failure occurs when a critical concentration is reached which is nearly independent of the applied stress. ESRO

N73-23918# California Univ., Los Angeles. Dept. of Mathematics.
THE ROLE OF RESONANT INTERACTION IN THE DYNAMIC STABILITY OF ELASTIC SYSTEMS
Charles G. Lange and Alan C. Newell 1973 14 p refs Prepared in cooperation with Clarkson Coll. of Technol., Potsdam, N. Y.
(Contract N00014-69-A-0200-4022; Grant NSF GP-32839X; NR Proj. 044-144)
(AD-756237) Avail: NTIS CSCL 20/11

A resonance phenomenon which can occur in elastic systems supporting wave motion is discussed. An analytical and numerical study of the dynamic stability of a cylindrical shell under axial compression illustrates the potential importance of this resonance phenomenon for imperfection-sensitive structures.
Author (GRA)

N73-23919# New Mexico State Univ., University Park.
STATIC CONCRETE CONSTITUTIVE RELATIONS BASED ON CUBICAL SPECIMENS. VOLUME 1: MODEL DEVELOPMENT AND VERIFICATION Technical Report, Sep. 1970 - Aug. 1972
Elton G. Endebrock and Leonard A. Traina Dec. 1972 220 p refs
(Contract F29601-71-C-0007; AF Proj. 5710)
(AD-756926; AFWL-TR-72-59-Vol-1) Avail: NTIS CSCL 13/3

Uniaxial, biaxial, and triaxial tests were performed on three-inch cubes using various combinations of compressive and tensile loads. One nominal concrete strength of 4000 psi was used in the testing. The testing machine and its associated hardware such as load cells, platens, and extensometers were designed as a part of this study. The test information was obtained as stress-strain records for the three principal directions of the cubical test specimens. The tests were run until the largest compressive stress reached 30,000 psi or there was a tensile failure. Whenever possible the test results were compared to those of other investigators. A model to simulate concrete behavior was developed. (Author Modified Abstract) GRA

N73-23920# New Mexico State Univ., University Park.
STATIC CONCRETE CONSTITUTIVE RELATIONS BASED ON CUBICAL SPECIMENS. VOLUME 2: ADDITIONAL TESTING OF CUBICAL SPECIMENS Technical Report, Sep. 1970 - Aug. 1972
Elton G. Endebrock and Leonard A. Traina Dec. 1972 46 p refs
(Contract F29601-71-C-0007; AF Proj. 5710)

(AD-756927; AFWL-TR-72-59-Vol-2) Avail: NTIS CSCL 13/3

Uniaxial, biaxial, and triaxial compressive tests were conducted on cubical test specimens cast and brought to small dimensional tolerances. The primary purpose of the tests was to determine if the test-to-test variation could be reduced by using the carefully prepared test cubes. The test-to-test variation was reduced using the specially prepared cubes. The results obtained from these tests were compared to the results obtained in the primary testing program. The initial tangent modulus from the uniaxial tests of this program was used in the computer solution to the model. (Author Modified Abstract) GRA

N73-23921# Kaman Aerospace Corp., Bloomfield, Conn.

RESEARCH ON STRUCTURAL DYNAMIC TESTING BY IMPEDANCE METHODS. VOLUME 1: STRUCTURAL SYSTEM IDENTIFICATION FROM MULTIPOINT EXCITATION Final Report

William G. Flannelly, Alex Berman, and Nicholas Giansante Nov. 1972 152 p refs

(Contract DAAJ02-70-C-0012; DA Proj. 1F1-62204-AA-43)

(AD-756389; R-1001-1-Vol-1; USAAMRDL-TR-72-63A-Vol-1) Avail: NTIS CSCL 20/11

The report is presented in four volumes, each describing a separate phase of the basic theory of structural dynamic testing using impedance techniques. Volume I presents the results of an analytical and numerical investigation of the practicality of system identification using fewer measurement points than there are degrees of freedom. The parameters in Lagrange's equations of motion, mass, stiffness, and damping for a mathematical model having fewer degrees of freedom than the linear elastic structure it represents may be determined directly from measured mobility data. Author (GRA)

N73-23922# Kaman Aerospace Corp., Bloomfield, Conn.

RESEARCH ON STRUCTURAL DYNAMIC TESTING BY IMPEDANCE METHODS. VOLUME 2: STRUCTURAL SYSTEM IDENTIFICATION FROM SINGLE-POINT EXCITATION Final Report

William G. Flannelly, Alex Berman, and Nicholas Giansante Nov. 1972 88 p refs

(Contract DAAJ02-70-C-0012; DA Proj. 1F1-62204-AA-43)

(AD-756390; R-1001-2-Vol-2; USAAMRDL-TR-72-63B-Vol-2) Avail: NTIS CSCL 20/11

The report is presented in four volumes, each describing a separate phase of the basic theory of structural dynamic testing using impedance techniques. Volume II describes the method of system identification wherein the necessary impedance data are experimentally determined by applying a force excitation at a single point on the structure. Author (GRA)

N73-23923# Kaman Aerospace Corp., Bloomfield, Conn.

RESEARCH ON STRUCTURAL DYNAMIC TESTING BY IMPEDANCE METHODS. VOLUME 3: FREE-BODY RESPONSE Final Report

Alex Berman, Nicholas Giansante, and William G. Flannelly Nov. 1972 53 p refs

(Contract DAAJ02-70-C-0012; DA Proj. 1F1-62204-AA-43)

(AD-756391; R-1001-3-Vol-3; USAAMRDL-TR-72-63C-Vol-3) Avail: NTIS CSCL 20/11

The report is presented in four volumes, each describing a separate phase of the basic theory of structural dynamic testing using impedance techniques. Volume 3 presents a method of determining the free-body dynamic responses from data obtained on a constrained structure. Author (GRA)

N73-23924# Kaman Aerospace Corp., Bloomfield, Conn.

RESEARCH ON STRUCTURAL DYNAMIC TESTING BY IMPEDANCE METHODS. VOLUME 4: SUBSYSTEMS Final Report

Nicholas Giansante, William G. Flannelly, and Alex Berman Nov. 1972 53 p refs

(Contract DAAJ02-70-C-0012; DA Proj. 1F1-62204-AA-43)

(AD-756392; R-1001-4-Vol-4; USAAMRDL-TR-72-63D-Vol-4) Avail: NTIS CSCL 20/11

The report is presented in four volumes, each describing a separate phase of the basic theory of structural dynamic testing using impedance techniques. Volume 4 describes a method of obtaining the equations for the combination of measured mobility matrices of a helicopter and its subsystems. The response of the combination of a helicopter and its subsystems is determined from data based on the experimental results of the main system and subsystems separately. Author (GRA)

N73-23925# Army Missile Command, Redstone Arsenal, Ala. Ground Equipment and Materials Directorate.

DISTRIBUTION OF STRESS ACROSS THE THICKNESS NEAR A CRACK TIP IN A PLATE SUBJECTED TO APPROXIMATE CYLINDRICAL BENDING

Bobby Ray Mullinix 30 Oct. 1972 131 p refs

(AD-757207; RL-72-11) Avail: NTIS CSCL 20/11

The inplane stress distribution across the thickness is determined by two different methods for a plate loaded in bending. It was found from experimental work that the use of a nonlinear function for the inplane stress distribution across the plate thickness does not result in any significant improvement in the accuracy of the theory for the geometry of through cracks in thin and moderately thick plates. The maximum actual transverse normal stress was approximately one-half the plane strain value. GRA

N73-23926# Alabama Univ., Huntsville. Dept. of Engineering Mechanics.

STATIC AND DYNAMIC ANALYSIS OF VISCOELASTOPLASTIC FIBER REINFORCED COMPOSITE SHELLS IN MISSILE STRUCTURES Annual Report, 1 Jan. - 31 Dec. 1972

T. J. Chung and Robert L. Eidson Jan. 1973 204 p refs

(Contract DAAH01-72-C-0281)

(AD-756465) Avail: NTIS CSCL 20/11

The report is concerned with theories, formulations, and computer programs for the analysis of shell structures in general and fiber reinforced rocket motor cases in particular. Axisymmetric isothermal deformations subjected to either static or dynamic loading are included in the present study. All possible material properties such as elastic, viscoelastic, elastoplastic, and viscoelastoplastic are explored. Analyses are carried out with the structure regarded either as a thin shell or as a thick shell. It was found that the thin shell theory is inadequate for yielding of many layers of fibers through the shell thickness. The finite element method is used in handling unusual geometry and boundary conditions, and various modern numerical schemes are employed in domains of space and time. Author (GRA)

N73-23927# Air Force Systems Command, Wright-Patterson AFB, Ohio. Foreign Technology Div.

SOLUTION OF THE PROBLEM OF TRANSVERSE OSCILLATIONS IN PRISMATIC SHELLS FILLED WITH LIQUID PLANE PROBLEM

B. N. Ostroverkh 19 Jan. 1973 16 p refs Transl. into ENGLISH of Gidromekh.(USSR), no. 16, 1970 p 91-96

(AD-755416; FTD-HT-23-1794-72) Avail: NTIS CSCL 20/11

Analysis of the free transverse oscillations of a closed prismatic shell composed of flexible rectangular panels and filled with a compressible inviscid liquid. A procedure for determining the frequencies of these oscillations by the Ritz variational method is described. The Ostrogradskii-Hamilton expression is used to determine the functional of this variational problem, showing that the functional is a function of the bending of elements of the shell. It is shown that the frequency of the free transverse oscillations of a shell of this type can be reduced by more than 60% when the shell is filled with a compressible inviscid liquid. Author (GRA)

N73-23928# Air Force Academy, Colo.

ANALYSIS OF PART-THROUGH QUARTER-CIRCULAR CRACKS EMANATING FROM THE BOUNDARY OF AN INTERNAL CIRCULAR HOLE IN A PLATE

Terry D. Hinnerichs and Lanny J. Larson Dec. 1972 44 p refs

(AD-757550; USAFA-RR-72-9) Avail: NTIS CSCL 20/11

The report develops an approximate equation for determining stress intensities for partially embedded quarter-circular flaws emanating from a circular hole in a sheet material. The development involved the use of the stress concentration factor for a hole in a plate to take into account the effects that the hole has on the cracktip stress intensity. A design criteria less conservative than the through-crack method is proposed for

handling a partially embedded crack emanating from a circular hole. (Author Modified Abstract) GRA

N73-23929# Naval Intelligence Support Center, Washington, D.C. Translation Div.
STABILITY OF A CYLINDRICAL SHELL STIFFENED BY FRAMES AND LOADED WITH EXTERNAL PRESSURE
A. I. Manevich 2 Feb. 1973 12 p refs Transl. into ENGLISH from Izv. Akad. Nauk SSSR, Mekhan. (Moscow), no. 6, 1965 p 106-110
(AD-757726; NISC-TRANS-3389) Avail: NTIS CSCL 20/11

The problem of determining the minimum rigidity of frames stabilizing a given cylindrical shell under a given external pressure is examined. GRA

N73-23930# Notre Dame Univ., Ind. Coll. of Engineering.
THERMAL ANALYSIS OF PLATES WITH CIRCULAR INCLUSIONS
A. L. McFall, T. Ariman, and L. H. N. Lee Feb. 1973 43 p refs
(Contract N00014-68-A-0152; NR Proj. 260-112)
(AD-756183; UND-73-2) Avail: NTIS CSCL 20/11

A least square boundary point matching method is employed to determine the temperature distributions and deformations of rectangular plates with circular elastic inclusions. Solutions for two problems have been obtained. The first problem is concerned with the determination of the temperature distribution in a finite rectangular plate having a circular inclusion and subjected to prescribed temperature distribution and thermal conditions along the edges. The plate is heated uniformly through the thickness. The second problem is concerned with the deflection and moment distribution in the same plate model with simply supported edges and prescribed temperature variation across the thickness but not temperature variation over the plate surface. Numerical results are presented. Author (GRA)

N73-23931# Massachusetts Inst. of Tech., Cambridge. Aeroelastic and Structures Research Lab.
ASSUMED STRESS HYBRID FINITE-ELEMENT METHOD FOR FRACTURE MECHANICS AND ELASTIC-PLASTIC ANALYSIS
Chih-Hung Luk Dec. 1972 155 p refs
(Contract F44620-72-C-0018; AF Proj. 9782)
(AD-757523; ASRL-TR-170-1; AFOSR-73-0493TR) Avail: NTIS CSCL 20/11

The purpose of the report is to investigate the feasibility of the assumed stress hybrid finite element method on the analysis of linear fracture mechanics and the elastic-plastic analysis. The hybrid stress model is applied for the evaluation of the elastic stress intensity factors at the tip of a sharp crack. Example solutions include plane stress cracks of both the opening type and the in-plane shear type for isotropic materials and of the opening type for anisotropic materials. Convergence of the numerical solution and the optimum arrangement of the finite element meshes have also been studied. The hybrid stress model is applied to the determination of the static response for structures with elastic-plastic material behaviors. (Author Modified Abstract) GRA

N73-23932# Lockheed Missiles and Space Co., Palo Alto, Calif.
ON THE INFLUENCE OF TRANSVERSE VIBRATIONS ON THE STABILITY OF RECTANGULAR PLATES
V. S. Kalinin [1973] 9 p refs Transl. into ENGLISH from the rock "Problemy Mekhaniki Tverdogo Deformirovannogo Tela' Leningrad, Sudostr., 1970 p 187-195
Avail: NTIS HC $3.00, National Translations Center, John Crerar Library, Chicago, Ill. 60616

The influence of transverse vibrations on the stability of rectangular plates is discussed. It is shown that the stability of rectangular plates with a brace can be raised by maintaining forced transverse, low frequency vibrations if the vibrations began to be excited during subcritical compression. It is also shown that forced transverse vibrations can result in instability of a plate with a brace compressed by subcritical forces. Mathematical models are included to support the theoretical considerations. Author

N73-23933# Naval Research Lab., Washington, D.C.
A REVIEW OF THE PLANE-STRESS FRACTURE MECHANICS PARAMETER Kc DETERMINED USING THE CENTER CRACKED TENSION SPECIMEN
Anna M. Sullivan and Charles N. Freed 29 Dec. 1972 52 p refs
(NRL Proj. M01-24)
(AD-757654; NRL-7460) Avail: NTIS CSCL 20/11

The report discusses the current status of the center-cracked tension (CCT) specimen as a means of determining the plane-stress fracture-mechanics parameter Kc. The effect of specimen geometry (width and crack length) together with that of specimen thickness is illustrated by examples from NRL research. The experimental parameters employed at NRL are detailed together with those in use at other laboratories for the purpose of assisting in the development of a standard procedure for such testing so that data can be reliably compared. Author (GRA)

N73-23934# Army Missile Command, Redstone Arsenal, Ala. Ground Equipment and Materials Directorate.
AN EXPERIMENTAL TECHNIQUE FOR INVESTIGATING STRESS INTENSITY AROUND SURFACE FLAWS
Dallas G. Smith, Bobby R. Mullinix, and Wen-Sheng Chan 28 Nov. 1972 57 p refs
(DA Proj. 1T0-61101-A-91A)
(AD-758140; RL-72-20) Avail: NTIS CSCL 20/11

An experimental technique for investigating the stress intensity around surface flaws is presented. The photoelastic stress freezing and slicing method is used to determine the stress intensity factor at various points around the circular edge of a surface flaw embedded in a plate subjected to extensional loads. The effect of the flaw depth to plate thickness ratio is included in this work. Data from three different geometries are compared to interpolated and extrapolated results from the best theory presently available. A second photoelastic technique was applied to the same geometry and loading as the first experiment and good agreement of the two methods was obtained. Author (GRA)

N73-23935# Naval Ship Research and Development Center, Bethesda, Md.
BENDING FLUTTER AND TORSIONAL FLUTTER OF FLEXIBLE HYDROFOIL STRUTS
Peter K. Besch and Yuan-Ning Liu Feb. 1973 65 p refs
(AD-757645; NSRDC-4012) Avail: NTIS CSCL 13/10

A large body of experimental and theoretical flutter results for hydrofoil struts were analyzed to determine significant characteristics. Flutter was found to occur in two different structural mode shapes, corresponding to a predominantly bending mode and a predominantly torsional mode, respectively. The flutter mode shape was related to the vibration mode shapes and the generalized mass ratio of the strut at zero speed. The behavior of the hydroelastic modes of typical struts as a function of speed was investigated by using a strip theory with three-dimensional loading modifications. Flutter predictions for struts which underwent flutter in the torsional mode were usually conservative and predicted the correct mode shape. (Author Modified Abstract) GRA

N73-23936# Naval Postgraduate School, Monterey, Calif.
ANALYSIS OF AXISYMMETRICALLY LOADED CYLINDRICAL AND SPHERICAL PRESSURE VESSELS FOR VARIOUS LOADING CONDITIONS M.S. Thesis
Yusuf Czturk Dec. 1972 142 p refs
(AD-758496) Avail: NTIS CSCL 13/13

Formulas relating to the elastic behavior of axisymmetrically loaded cylindrical and spherical pressure vessels have been collected from various sources. Their presentation is unified by the employment of a uniform system of notation. Loadings include interior and exterior pressurization, radial and axial temperature gradients, axial loads, and centrifugal force fields. Some cases of buckling are treated, and shrink assembled multilayer vessels are included. A large bibliography is listed. Author (GRA)

N73-23605 Cranfield Inst. of Technology (England).
WHAT IS THE ROLE OF STRESS IN OXIDATION, INCLUDING BOTH EXTERNALLY-APPLIED AND GROWTH STRES-

SES? WHAT ARE THE MODES OF STRESS-RELAXATION? HOW DOES THERMAL CYCLING AFFECT THE STRESSES AND STRESS RELAXATION?
P. Hancock *In* AGARD High Temp. Corrosion of Aerospace Alloys Mar. 1973 p 117-128 refs (For availability see N73-23597 14-17)

33 THERMODYNAMICS AND COMBUSTION

Includes ablation, cooling, heating, heat transfer, thermal balance, and other thermal effects; and combustion theory. For related information see also: 12 Fluid Mechanics; and 27 Propellants.

N73-23937 Engineering Sciences Data Unit, London (England).
APPROXIMATE TRANSPORT PROPERTIES OF HIGH-TEMPERATURE AIR IN DISSOCIATION EQUILIBRIUM
Jul. 1972 9 p refs
(ESDU-00.01.07-Amend-A) Copyright. Avail: Issuing Activity
Graphs, showing dissociation equilibrium, approximate transport properties, and ionization of nitrogen and oxygen in high temperature air, are presented. E.H.W.

N73-23938*# Pittsburgh Univ., Pa.
NET VAPOR GENERATION POINT IN BOILING FLOW OF TRICHLOROTRIFLUOROETHANE AT HIGH PRESSURES
R. S. Dougall and T. E. Lippert Washington NASA May 1973 91 p refs
(Grant NGL-39-011-079)
(NASA-CR-2241) Avail: NTIS HC $3.00 CSCL 20M
The conditions at which the void in subcooled boiling starts to undergo a rapid increase were studied experimentally. The experiments were performed in a 12.7 x 9.5 mm rectangular channel. Heating was from a 3.2 mm wide strip embedded in one wall. The pressure ranged from 9.45 to 20.7 bar, mass velocity from 600 to 7000 kg/sq m sec, and subcooling from 16 to 67 C. Photographs were used to determine when detached bubbles first appeared in the bulk flow. Measurements of bubble layer thickness along the wall were also made. Results showed that the point of net vapor generation is close to the occurrence of fully-developed boiling. Author

N73-23939# Kyushu Univ., Fukuoka (Japan).
AN ANALYTICAL STUDY ON RADIATIVE HEAT TRANSFER OF GASEOUS SUSPENSION FLOW OF SOLID AND LIQUID PARTICLES WITH INTERNAL HEATING
Ryozo Echigo and S. Hasegawa Mar. 1973 15 p refs Repr. from Mem. of the Fac. of Eng. Kyushu Univ. (Japan), v. 32, no. 4, Mar. 1973 p 223-232
Avail: NTIS HC $3.00
Presentation is made of a theoretical analysis to examine the radiative heat transfer from gaseous suspension flow with internal heating. The energy equations are formulated for the fully developed laminar or turbulent flow in a pipe by taking account of radiant energy. The basic equations constitute simultaneous intergro-differential equations for the dispersed particulate phase and carrier fluid phase, the solutions of which are evaluated by numerical procedure. The temperature profiles of both phases are illustrated for the wide ranges of dimensionless parameters such as loading ratio of particles to fluid, the conduction radiation ratio, and optical length of duct. In addition, the heat transfer characteristics are summarized and the heat transfer mechanism is examined briefly. Author

N73-23940# Sud-Aviation, Paris (France).
POSSIBILITY OF THE UTILIZATION OF A ERIDAN FUSE PROBE IN EXPERIMENTAL VEHICLES [POSSIBILITE D'UTILISATION DE LA FUSEE-SONDE ERIDAN EN TANT QUE VEHICULE EXPERIMENTAL]
A. Omnes Soc. Natl. Ind. Aerospatiale 1972 27 p In FRENCH Presented at 9th Conf. on Appl. Aerodyn., Paris, 8 and 10 Nov. 1972 and in Saint-Cyr-l'Ecole, 9 Nov. 1972
Avail: NTIS HC $3.50
The performance of an Eridan rocket probe in experimental vehicles is investigated. Data cover flight tests, probe configurations, performance limits, and probe measurements during flight. Vibration effects and aerodynamic stability are also examined.
Transl. by E.H.W.

N73-23941# Lockheed Missiles and Space Co., Palo Alto, Calif.
THERMOSPHYSICAL PROPERTIES AND THERMODYNAMICS CHARACTERISTICS OF SOME HEAT ACCUMULATING MATERIALS
A. T. Ulubekov, A. G. Chukaev, and M. Sh. Iagfarov [1973] 4 p refs Transl. into ENGLISH from Izv. Vyssh. Ucheb. Zaved., Mashinostro. (Moscow), no. 1, 1973 p 91-95
Avail: NTIS HC $3.00; National Translations Center, John Crerar Library, Chicago, Illinois 60616
Results of an experiment to determine the specific heat of conduction are given along with results of a computation of the thermodynamic characteristics of some organic and inorganic heat accumulating materials. the investigations were conducted for the melting domain. Author

N73-23942# Lockheed Missiles and Space Co., Palo Alto, Calif.
NONACOUSTIC WAVE INSTABILITY OF PROCESSES IN A SOLID FUEL ENGINE
Iu. A. Gostintsev, L. A. Sukhanov, and P. F. Pokhill [1972] 7 p refs Transl. into ENGLISH from Fiz. Goreniya Vzryva (Novsibirsk), v. 8, no. 2, 1972 p 273-279
Avail: NTIS HC $3.00, National Translations Center, John Crerar Library, Chicago, Ill. 60616
In an examination of endface combustion of a powder charge in a cylindrical half-closed combustion chamber the continuity, motion, and energy equations for the ideal combustion products are provided. Experimental results indicate that the mechanism of the self-oscillations examined are governed by the generation of entropy (temperature) waves by the flame. J.M.M.

N73-23943*# National Aeronautics and Space Administration. Lewis Research Center, Cleveland, Ohio.
EFFECT OF PRIMARY-ZONE WATER INJECTION ON POLLUTANTS FROM A COMBUSTOR BURNING LIQUID ASTM A-1 AND VAPORIZED PROPANE FUELS
Robert D. Ingebo and Carl T. Norgren Washington May 1973 19 p refs
(NASA-TN-D-7293; E-7355) Avail: NTIS HC $3.00 CSCL 21B
A combustor segment 0.457 meter (18 in.) long with a maximum cross section of 0.153 by 0.305 meter (6 by 12 in.) was operated at inlet-air temperatures of 590 and 700 K, inlet-air pressures of 4 and 10 atmospheres, and fuel-air ratios of 0.014 and 0.018 to determine the effect of primary-zone water injection on pollutants from burning either propane or ASTM A-1 fuel. At a simulated takeoff condition of 10 atmospheres and 700 K, multiple-orifice nozzles used to inject water at 1 percent of the airflow rate reduced nitrogen oxides 75 percent with propane and 65 percent with ASTM A-1 fuel. Although carbon monoxide and unburned hydrocarbons increased with water injection, they remained relatively low; and smoke numbers were well below the visibility limit. Author

N73-23944*# Michigan Univ., Ann Arbor. Dept. of Aerospace Engineering.
THEORETICAL ANALYSIS OF ROTATING TWO PHASE DETONATION IN A ROCKET MOTOR
I-wu Shen and T. C. Adamson, Jr. Mar. 1973 65 p refs
(Grant NGL-23-005-336)
(NASA-CR-121194) Avail: NTIS HC $5.25 CSCL 21B
Tangential mode, non-linear wave motion in a liquid propellant rocket engine is studied, using a two phase detonation wave as the reaction model. Because the detonation wave is followed immediately by expansion waves, due to the side relief in the axial direction, it is a Chapman-Jouguet wave. The strength of this wave, which may be characterized by the pressure ratio across the wave, as well as the wave speed and the local wave Mach number, are related to design parameters such as the contraction ratio, chamber speed of sound, chamber diameter, propellant injection density and velocity, and the specific heat ratio of the burned gases. In addition, the distribution of flow properties along the injector face can be computed. Numerical calculations show favorable comparison with experimental

findings. Finally, the effects of drop size are discussed and a simple criterion is found to set the lower limit of validity of this strong wave analysis. Author

N73-23945*# National Aeronautics and Space Administration. Langley Research Center, Langley Station, Va.
EFFECTS OF MATERIAL COMPOSITION ON THE ABLATION PERFORMANCE OF LOW DENSITY ELASTOMERIC ABLATORS
Stephen S. Tompkins and Walter P. Kabana Washington May 1973 34 p refs
(NASA-TN-D-7246; L-8683) Avail: NTIS HC $3.00 CSCL 20M

The ablation performance of materials composed of various concentrations of nylon, hollow silica spheres, hollow phenolic spheres, and four elastomeric resins was determined. Both blunt-body and flat-panel specimens were used, the cold-wall heating-rate ranges being 0.11 to 0.8 MW/sq m, respectively. The corresponding surface pressure ranges for these tests were 0.017 to 0.037 atmosphere and 0.004 to 0.005 atmosphere. Some of the results show that (1) the addition of nylon significantly improved the ablation performance, but the nylon was not compatible with one resin system; (2) panel and blunt-body specimen data do not show the same effect of phenolic sphere content on ablation effectiveness; and (3) there appears to be an optimum concentration of hollow silica spheres for good ablation performance. The composition of an efficient, nonproprietary ablator for lifting body application is identified and the ablation performance of this ablator is compared with the performance of three commercially available materials. Author

N73-23946*# Vought Missiles and Space Co., Dallas, Tex.
RADIATOR DESIGN SYSTEM COMPUTER PROGRAMS
C. L. Wiggins, J. A. Oren, and J. B. Dietz 13 Oct. 1971 164 p refs
(Contract NAS9-10810)
(NASA-CR-128913) Avail: NTIS HC $10.25 CSCL 22B

Minimum weight space radiator subsystems which can operate over heat load ranges wider than the capabilities of current subsystems are investigated according to projected trends of future long duration space vehicles. Special consideration is given to maximum heat rejection requirements of the low temperature radiators needed for environmental control systems. The set of radiator design programs that have resulted from this investigation are presented in order to provide the analyst with a capability to generate optimum weight radiator panels or sets of panels from practical design considerations, including transient performance. Modifications are also provided for existing programs to improve capability and user convenience. J.M.M.

N73-23947# National Research Council of Canada, Ottawa (Ontario). Div. of Mechanical Engineering.
FREE PISTON GASIFIER STUDIES. FURTHER DEVELOPMENT AND USE OF THE HYBRID SIMULATION
A. Swiderski, F. Rueter, and R. E. Gagne Jan. 1973 42 p refs
(ME-240) Avail: NTIS HC $4.25

Previous work on the modeling of the free piston gasifier was extended to include refined models of the combustion process and of engine friction. The model was used to study the sensitivity of the engine performance to environmental and design parameters. Author

N73-23948# Stuttgart Univ. (West Germany). Inst. fuer Kernenergetik.
LIFETESTS OF HEAT PIPES FOR TEMPERATURE CONTROL OF A METEOROLOGICAL SATELLITE Final Report
Feb. 1973 38 p
(Contract ESTEC-1152/70-EL)
Avail: NTIS HC $4.00

The long term operation of five low temperature acetone/copper heat pipes was discussed. The project was based on a series of accelerated life tests which included low power and high power tests. Experimental results are discussed. It was shown that thermal cycling tests should be substituted by thermal shock tests. ESRO

N73-23949# Institute for Defense Analyses, Arlington, Va.
ON THE PROBLEM OF ELIMINATING NITRIC OXIDE FROM JET ENGINE EXHAUST
J. W. Chamberlain Aug. 1972 8 p refs
(AD-757059; N-815; IDA/HQ-72-14447) Avail: NTIS CSCL 04/1

The report discusses the possibility that nitric oxide (NO) in the exhaust of a fleet of SSTs could seriously affect the ozone equilibrium of the stratosphere. In this connection it has been suggested that artificial excitation (vibrational or electronic) of NO in the combustion chamber could increase its reaction rate so that NO is converted into the more inert N2. The maximum rate that could likely be thus obtained seems inadequate to deplete the NO abundance appreciably. However, there are still uncertainties in the parameters and the mechanism cannot be totally discounted. Author (GRA)

N73-23950# Air Force Inst. of Tech., Wright-Patterson AFB, Ohio. School of Engineering.
A NUMERICAL PROCEDURE FOR TWO DIMENSIONAL HEATING AND MELTING CALCULATIONS, WITH APPLICATIONS TO LASER EFFECTS
Peter J. Torvik Mar. 1972 58 p refs
(AD-757189; AFIT-TR-72-2) Avail: NTIS CSCL 20/13

A method for determining the two-dimensional transient temperature distribution and progression of melting in disks subjected to an applied flux over one face is given. The calculations are performed by dividing the solid into a number of finite elements and performing a heat balance over finite time increments. The method was found to give good agreement with known solutions for two-dimensional heat conduction problems and one-dimensional melting problems. Two-dimensional melting problems in alumina, titanium, stainless steel, and magnesium are also considered as examples of the method. The results include a demonstration that the time required to melt through approaches the time predicted by a one-dimensional (axial) heat balance if the power per unit thickness is sufficiently large. Author (GRA)

N73-23951# Air Force Systems Command, Wright-Patterson AFB, Ohio. Foreign Technology Div.
ANALYSIS OF THE KINETICS OF THE AFTERBURNING PROCESS UPON INJECTING AN OXIDIZER INTO A HIGH TEMPERATURE FLOW
Z. G. Shaikhutdinov 26 Jan. 1973 15 p refs Transl. into ENGLISH from Tr. Ufimsk. Aviats. Inst. (Ufa), no. 17, 1970 p 3-8
(AD-756098; FTD-HT-23-1695-72) Avail: NTIS CSCL 21/2

When N2O4 is injected into a high temperature gas flow containing the products of the incomplete combustion of CO and H2, effective aterburning of these products can be expected. This article deals with the calculation tables used for a rough analysis of the kinetic laws governing these processes. Author (GRA)

N73-23952# Naval Postgraduate School, Monterey, Calif.
AMMONIUM PERCHLORATE AND AMMONIUM PERCHLORATE: BINDER SANDWICH COMBUSTION
J. L. Murphy and D. W. Netzer 1 Feb. 1973 46 p refs
(AD-757347; NPS-57NT13021A) Avail: NTIS CSCL 21/2

Single crystal and pressed polycrystalline ammonium perchlorate (AP) wafers, pressed polycrystalline AP pellets, and ammonium perchlorate-binder (polybutadiene acrylic acid, hydroxyl terminated polybutadiene, polyurethane, and carboxyl terminated polybutadiene) sandwiches were burned in a schlieren equipped combustion bomb and in a centrifuge mounted combustion bomb. High-speed color schlieren and regular motion pictures were taken of the combustion process to determine the effects of pressure, binder type, binder thickness, and purity of ammonium perchlorate on the AP deflagration. AP pellet fabrication techniques and burning rate acceleration sensitivity were also investigated. Author (GRA)

N73-23953*# Naval Ordnance Lab., White Oak, Md.
THE SAFETY AND RELIABILITY OF THE S AND A MECHANISM DESIGNED FOR THE NASA/LSPE PROGRAM
Louis J. Montesi 23 Jan. 1973 89 p refs Sponsored by NASA
(NOL Proj. 998/NASA)

(NASA-CR-131985; AD-757010; NOLTR-72-294) Avail: NTIS HC $6.50 CSCL 19/1

Under contract to the Manned Spacecraft Center, NASA/Houston, NOL developed a number of explosive charges for use in studying the surface of the moon during Apollo 17 activities. The charges were part of the Lunar Seismic Profiling Experiment (LSPE). When the Safety and Arming Device used in the previous ALSEP experiments was found unsuitable for use with the new explosive packages, NOL also designed the Safety and Arming Mechanism, and the safety and reliability tests conducted are described. The results of the test program indicate that the detonation transfer probability between the armed explosive components exceeds 0.9999, and is less than 0.0001 when the explosive components are in the safe position.

Author (GRA)

N73-23954# Ballistic Research Labs., Aberdeen Proving Ground, Md.

BURNING RATE STUDIES ON THE CLOSED CHAMBER COMBUSTION OF A FUEL AIR PROPELLANT Final Memorandum Report

John D. Knapton and Irvin C. Stobie Feb. 1973 40 p refs

(AD-757634; BRL-MR-2273) Avail: NTIS CSCL 19/1

Closed chamber studies were performed on the combustion of the fuel air propellant JP4 and air. Densities of loading were varied from 0.18 to 0.36 gm/cubic centimeters. Equivalence ratios were varied from 0.6 to 2.7 fuel to air. A method for calculating the effective burning rate is presented. It was found that a wide variation in the actual burning rate can be obtained depending, approximately, on the inverse of the fuel air mixing time and, to a lesser extent, on the equivalence ratio. The pressure-time data is used to interpret the pressure rise predicted by an isothermal model, an adiabatic model, a reduced pressure model, and a volumetric model. Comparison of the results demonstrated that the reduced pressure model and the volumetric model offer the best pressure-time correlation. (Author Modified Abstract) GRA

N73-23955# Naval Postgraduate School, Monterey, Calif.

VAPORIZATION OF THIN LIQUID FILMS M.S. Thesis

Donald Kenneth MacKenzie Dec. 1972 91 p refs

(AD-757280) Avail: NTIS CSCL 20/13

Experimental results are presented for saturated nucleate pool boiling of distilled water and ethyl-alcohol from 1-7/8 inch diameter nickel disks with pool depths from 1.0 inch to a thin film of 0.015 inch. Experimental runs were conducted on a mirrorlike surface using distilled water and ethyl-alcohol; on a grooved surface with distilled water as the working fluid; and on a surface covered with 4 layers of nickel 50 x 40 mesh with distilled water as the working fluid. Results show that liquid level has little effect on the heat transfer coefficient above a level of 0.2 inch on all three test surfaces; However, below 0.2 inch a rapid increase in the heat transfer coefficient occurs with the lowering of the liquid level. Two types of thin film dryout were noted on the mirrorlike surface: dryout under a dome and dryout in absence of a dome. A grooved surface appears to provide a means of obtaining a stable high heat transfer coefficient at liquid films as thin as 0.015 inch.

Author (GRA)

N73-23956# Naval Postgraduate School, Monterey, Calif.

INVESTIGATION OF THE PERFORMANCE OF A GAS-LOADED VARIABLE CONDUCTANCE HEAT PIPE M.S. Thesis

Keith Earl Reynolds Dec. 1971 81 p refs

(AD-757684) Avail: NTIS CSCL 13/1

A variable conductance heat pipe was designed and constructed to study the performance characteristics of the gas loaded heat pipe with particular emphasis on the effect of gravity. Heat inputs were varied from 10 to 50 watts and the operating position of the pipe was varied from horizontal to vertical with the condenser above the evaporator. Condenser temperature profiles are presented for various heat inputs and positions for the conventional and gas loaded heat pipe. The possibility of stratification in a horizontal heat pipe operating with a non-condensable gas that has a larger molecular weight than the working fluid is discussed based on observations presented. (Author Modified Abstract) GRA

N73-23957# Instituto Nacional de Tecnica Aeroespacial, Madrid (Spain).

DROPLET COMBUSTION AT HIGH PRESSURES WITH UNSTEADY EFFECTS Final Report, 1 Jun. 1969 - 31 May 1972

Carlos Sanchez Tarifa and Antonio Crespo 20 Dec. 1972 80 p refs

(Contract F61052-69-C-0035; AF Proj. 9711)

(AD-757227; AFOSR-73-0433TR) Avail: NTIS CSCL 21/2

To describe subcritical combustion, there are quasisteady theories based on the fact that the ratio of gas density to liquid density, epsilon, is small. At large pressures below critical, epsilon is not too small and unsteady effects become more important. It is found that, far from the droplet, at distances of the order of the droplet radius divided by the square root of epsilon, there is an unsteady region that originates corrections to mass burning rates, given by quasisteady theories, of order square root of epsilon. For most hydrocarbons burning in air the flame is located far from the droplet, and its position is not given, even in first approximation, by quasisteady theories. Unsteady effects are also analyzed for forced convection burning with Peclet numbers of order square root of epsilon. (Author Modified Abstract) GRA

N73-23958# Aerospace Corp., El Segundo, Calif.

SURVEY OF CRYOGENIC COOLING TECHNIQUES Technical Report, 1 Nov. 1970 - 15 May 1972

Martin Donabedian 30 Oct. 1972 188 p refs

(Contract F04701-72-C-0073)

(AD-755780; TR-0073(3901-01)-1; SAMSO-TR-73-34) Avail: NTIS CSCL 13/1

A survey was made to determine the state of the art of various methods of cooling to cryogenic temperatures for potential adaptation to spaceborne systems. The study included evaluation of mechanical closed-cycle refrigerators, open-cycle expendable systems, passive radiation concepts which utilize the low temperature of the deep space environment, and thermoelectric devices. The following mechanical refrigeration cycles were evaluated: Vuilleumier, Stirling, Gifford-McMahon/Solvay, Brayton and Claude. Open-cycle expendable systems evaluated were high-pressure gas coupled with Joule-Thomson expansion, cryogenic liquids in both the subcritical and supercritical state, solidified cryogens, and liquids storable at room temperature.

Author (GRA)

N73-23959# Yale Univ., New Haven, Conn. Dept. of Engineering and Applied Science.

INTERFACIAL CHEMICAL REACTIONS IN FLOW SYSTEMS Final Report, 1 Dec. 1969 - 31 Jan. 1973

Daniel E. Rosner 30 Mar. 1973 10 p refs

(Contract F44620-70-C-0026; AF Proj. 9750)

(AD-758256; AFOSR-73-0529TR) Avail: NTIS CSCL 21/2

The report very briefly summarizes the results of a 38 month basic research program at Yale University dealing with kinetic and transport factors governing interfacial mass transfer rates in high temperature systems. Specific cases studied in considerable detail are solute loss or gain by metals, the evaporation and combustion of liquid fuels (including metals), oxidation of solids leading to volatile reaction products, and sphere dissolution or growth in fluids. These phenomena are a central part of almost all advanced propulsion systems. GRA

N73-23602 Belgian Center for Corrosion Study, Brussels.

WHAT ARE THE ADVANTAGES AND LIMITATIONS IN THE USE OF EQUILIBRIUM THERMODYNAMICS FOR THE TREATMENT OF COMPLEX HIGH TEMPERATURE CORROSION REACTIONS?

M. Pourbaix *In* AGARD High Temp. Corrosion of Aerospace Alloys Mar. 1973 p 63-78 refs (For availability see N73-23597 14-17)

34 GENERAL

Includes information of a broad nature related to industrial applications and technology, and to basic research; defense aspects; information retrieval; management; law and related legal matters; and legislative hearings and documents.

N73-23960# Committee on Aeronautical and Space Sciences (U. S. Senate).
NASA AUTHORIZATION FOR FISCAL YEAR 1974, PART 2
Washington GPO 1973 809 p refs Hearings on S. 880 before Comm. on Aeron. and Space Sci., 93d Sess., 1st Sess., 12, 14-15, and 21-22 Mar. 1973
Avail: Comm. on Aeron. and Space Sci.

The hearings concerning the budget requirements for NASA activities during fiscal year 1974 are reported. The accomplishments by OSS during 1972 are reviewed, and the status of current programs is discussed along with planned projects. F.O.S.

N73-23961# Pennsylvania Univ., Philadelphia.
RESEARCH ACTIVITIES, ENGINEERING AND APPLIED SCIENCE, 1970-1972
Frank M. Steadman, ed. Dec. 1972 189 p
Avail: NTIS HC $11.50

A compilation of research work done by the University of Pennsylvania School of Chemical Engineering, Metallurgy and Materials Science, Electrical Engineering, and Civil and Mechanical Engineering is presented. E.H.W.

N73-23962# RAND Corp., Santa Monica, Calif.
GROWTH RATES WITHIN THE TRANSPORTATION SECTOR
W. E. Mooz Jan. 1973 10 p Presented at Sem. on Energy as a Scarce Resource, Pasadena, Calif., 9 Dec. 1972; sponsored by Environ. Qual. Lab., the Sierra Club, and League of Women Voters
(P-4935) Avail: NTIS HC $3.00

Report is made of an investigation into the nature of transportation in terms of energy depletion and fuel consumption. Graphic profiles are presented which trace the growth rates of specific modes of passenger and freight transportation from 1955 to 1968. A summary of likely transportation energy demands for the future is also included. J.M.M.

N73-23963# RAND Corp., Santa Monica, Calif.
ANALYSIS OF COMPLEX SYSTEMS: AN EXPERIMENT AND ITS IMPLICATIONS FOR POLICYMAKING
Garry D. Brewer Jan. 1973 64 p refs
(P-4951) Avail: NTIS HC $5.25

This investigation constitutes an integrative chapter for a larger collected work that details many of the special and undesirable aspects of large and complex systems. It represents an amalgamation of several disconnected intellectual styles and approaches to the understanding and management of the complexity of society. Several relevant theoretical areas of inquiry are discussed and interrelated, including scholarship from political science, psychology, organizational behavior, and communications. Report is made of a small illustrative experiment which was designed and operated to examine the effects of increasing a representative system's analytic size, the connectedness of its elements, and the degree of its temporal and spatial detail. Author

N73-23964# Comptroller General of the United States, Washington, D.C.
OBSERVATIONS OF VARIOUS ORGANIZATIONS AND INDIVIDUALS ON CERTAIN ASPECTS OF FEDERAL SUPPORT OF PROBLEM-ORIENTED RESEARCH
Elmer B. Staats 28 Mar. 1972 73 p
(B-133183) Avail: NTIS HC $5.75

The NSF Research Applied to National Needs program is described. Views on sponsoring and performing problem oriented research are included for federal, state, and local governments; academic institutions; and industrial organizations. Observations concerning federally sponsored research are presented. F.O.S.

N73-23965# Committee on Science and Astronautics (U. S. House).
NASA AUTHORIZATION, 1974, PART 2
Washington GPO 1973 1312 p refs Hearings on HR 4567 (Superseded by HR 7578) before Comm. on Sci. and Astronaut., 93d Congr., 1st Sess., No. 1, 27-28 Feb. and 1, 6-8, 13-15, 23, and 26 Mar. 1973 4 Vol.
Avail: Subcomm. on Manned Space Flight

Proceedings from Congressional hearings on various space projects are reported. Testimonies from various NASA personnel concerning the Skylab program, the Apollo/Soyuz test project, and other planned space missions and experiments are presented. For part 1, see N73-22930 J.A.M.

N73-23966# Committee on Science and Astronautics (U. S. House).
NASA AUTHORIZATION, 1974, PART 3
Washington GPO 1973 616 p refs Hearings on HR 4567 (Superseded by HR 7528) before Comm. on Sci. and Astronaut., 93d Congr., 1st Sess., No. 1, 6-7, 13-15, and 28-29 Mar. and 3-4 Apr. 1973 4 Vol.
Avail: Subcomm. on Space Sci. and Appl.

Hearings before the Subcommittee on Space Science and Applications were held for NASA's proposed applications budget. Several user-oriented activities, their progress, and future outlook are offered to show budgetary needs. Data are also given to support NASA's contention that its space related technology, systems, and other capabilities may be effectively applied and used in the civil sectors for the benefit of all people. E.H.W.

N73-23967# Committee on Science and Astronautics (U. S. House).
NASA AUTHORIZATION, 1974, PART 4
Washington GPO 1973 1323 p refs Hearings on HR 4567 (superseded by HR 7528) before Comm. on Sci. and Astronaut., 93d Congr., 1 Sess., No. 1, 6-8 and 13-15 Mar. 1973 4 Vol.
Avail: Subcomm. on Aeronaut. and Space Technol.

The proceedings of the hearings on aeronautics and space technology are presented which were conducted to determine policy, program priorities, and funding these priorities. Testimony by NASA personnel dealt with the aeronautical technology required for: (1) superiority in military aeronautics, (2) removal of air transport growth constraints, (3) efficient high-density short-haul systems, (4) U.S. long-haul aircraft and engine leadership, (5) aviation safety, and (6) general aviation. Space technology requirements identified include those for civil needs, for exploration of space, and for low cost exploitation of space. D.L.G.

N73-23968*# National Aeronautics and Space Administration. Goddard Space Flight Center, Greenbelt, Md.
SPACE AMONG US: SOME EFFECTS OF SPACE RESEARCH ON SOCIETY
Charles P. Boyle Jun. 1973 140 p refs
(NASA-TM-X-66233; X-207-72-27) Avail: NTIS HC $9.00 CSCL 05F

A wide range of effects, favorable and unfavorable, resulting from the space program are considered. The social effects, and technology application are discussed. F.O.S.

N73-23969# Committee on Science and Astronautics (U. S. House).
BRIEFINGS BEFORE THE TASK FORCE ON ENERGY, VOLUME 3
Washington GPO 1972 203 p refs Presented to Comm. on Sci. and Astronaut., 92d Congr., 2d Sess., 15 Aug. 1972
Avail: Subcomm. on Sci., Res., and Develop.

The hearings concerning the energy problems of the U.S. are reported. Topics discussed include: environmental protection, better use of natural resources, R and D priorities, water and air pollution, electric power generation, and economic growth. For Vol. 2, see N73-10980. F.O.S.

N73-23970*# Jet Propulsion Lab., Calif. Inst. of Tech., Pasadena.
JPL QUARTERLY TECHNICAL REVIEW, VOLUME 2, NUMBER 4
Jan. 1973 192 p refs
(Contract NAS7-100)
(NASA-CR-131799) Avail: NTIS HC $11.75 CSCL 05A

Research accomplishments are reported which include investigations of lipid-absorbing polymers, dental implantology, thermoluminescence applications in forensic science, solid state lasers for pyrotechnic ignition, narrow high current pulse generators, thick film silicon ribbon growth techniques, water resources information management systems, multiamplitude communication, visual aid systems for police helicopters, and computer-based pupil tracking/teacher monitoring systems. For individual titles, see N73-23971 through N73-23980.

N73-23971* Jet Propulsion Lab., Calif. Inst. of Tech., Pasadena.
LIPID ABSORBING POLYMERS **c04**
H. E. Marsh, Jr. and C. J. Wallace *In its* Quart. Tech. Rev., Vol. 2, No. 4 Jan. 1973 p 1-6 refs (For availability see N73-23970 14-34)
CSCL 06E

New polymers have been made that have the unusual property of being capable of absorbing both water and oils. As a result of this property, they are able to absorb lipids from micellar solutions. Lipid absorptions from model bile solution as high as 10% (based on dry polymer weight) in 5 min and 59% at equilibrium were measured. The presence of significant amounts of cholesterol, as well as of bile acid, in the absorbed lipids was confirmed by thin layer chromatography. Author

N73-23972* Jet Propulsion Lab., Calif. Inst. of Tech., Pasadena.
UNIFIED APPROACH TO THE BIOMECHANICS OF DENTAL IMPLANTOLOGY **c04**
D. E. Grenoble (Univ. of Southern Calif.) and A. C. Knoell *In its* Quart. Tech. Rev., Vol. 2, No. 4 Jan. 1973 p 7-17 refs (For availability see N73-23970 14-34)
CSCL 06B

A unified approach is proposed, using multidisciplinary systems technology, for the study of the biomechanical interactions between dental implants and host tissues. The approach progresses from biomechanical modeling and analysis, supported by experimental investigations, through implant design development, clinical verification, and education of the dental practitioner. Author

N73-23973* Jet Propulsion Lab., Calif. Inst. of Tech., Pasadena.
THERMOLUMINESCENCE: POTENTIAL APPLICATIONS IN FORENSIC SCIENCE **c06**
J. D. Ingham and D. D. Lawson *In its* Quart. Tech. Rev., Vol. 2, No. 4 Jan. 1973 p 18-28 refs (For availability see N73-23970 14-34)
CSCL 07D

In crime laboratories one of the most difficult operations is to determine unequivocally whether or not two samples of evidence of the same type were originally part of the same thing or were from the same source. In a continuing study it was found that high temperature thermoluminescence (room temperature to 723 K) can be used for comparisons of this type, although work to date indicates that there is generally a finite probability for coincidental matching of glass or soil samples. Further work is required to determine and attempt to minimize these probabilities for different types of materials, and to define more clearly the scope of applicability of thermoluminescence to actual forensic situations. Author

N73-23974* Jet Propulsion Lab., Calif. Inst. of Tech., Pasadena.
A HIGH EFFICIENCY, SMALL, SOLID STATE LASER FOR PYROTECHNIC IGNITION **c16**
L. C. Yang and V. J. Menichelli *In its* Quart. Tech. Rev., Vol. 2, No. 4 Jan. 1973 p 29-37 refs (For availability see N73-23970 14-34)
CSCL 20E

A completely self-contained, small, neodymium laser was designed and demonstrated for use in a pyrotechnic ignition system. A nominal 16 J of laser energy (1.06 micron wavelength, 1-ms duration) was achieved in a rectangular 10.5- x 15.1- x 25.4-cm package weighing 5.14 kg. This high energy-to-weight ratio is encouraging for laser applications in which specific energy efficiency (energy per unit weight or volume) is important. The laser design concepts are described, and some results on pyrotechnic ignition are given. Some details on a laser currently under construction, which will be 1/8 the size of the above laser, are included. Author

N73-23975* Jet Propulsion Lab., Calif. Inst. of Tech., Pasadena.
GENERATION OF NARROW HIGH CURRENT PULSES **c14**
V. J. Menichelli and L. A. Rosenthal *In its* Quart. Tech. Rev., Vol. 2, No. 4 Jan. 1973 p 38-43 (For availability see N73-23970 14-34)
CSCL 14B

Many of the fundamental factors affecting the initiation of electroexplosive devices have not been satisfactorily explained. A description of a narrow, high current pulse generator capable of pulses 4 microseconds wide and 94 amperes is given which should prove useful in the study of the initiation mechanism. Author

N73-23976* Jet Propulsion Lab., Calif. Inst. of Tech., Pasadena.
DEVELOPMENT OF A THICK FILM SILICON RIBBON GROWTH TECHNIQUE FOR APPLICATION TO LARGE-AREA SOLAR CELLS AND ARRAYS **c26**
P. A. Berman *In its* Quart. Tech. Rev., Vol. 2, No. 4 Jan. 1973 p 44-52 refs (For availability see N73-23970 14-34)
CSCL 20L

A technique is described for growth of large-area silicon ribbons. This technique is an edge-defined, film-fed growth process by which single crystals can be grown having a shape controlled by the outside dimensions of a shaping die, growth taking place from an extremely thin film of liquid fed by capillary action from a crucible below. The material from which the die is fabricated is very critical to the process. The die must be wet by the silicon, but adverse impurities must not be introduced into the silicon, and the die must not become degraded by the molten silicon. A breakthrough in die fabrication that has allowed the growth of silicon ribbons having dimensions of 1 cm by 30 cm with a thickness of 0.7 mm is described. The implications of this significant advancement with respect to development of photovoltaic solar arrays for wide-scale terrestrial solar-to-electric energy conversion systems are discussed. Author

N73-23977* Jet Propulsion Lab., Calif. Inst. of Tech., Pasadena.
INFORMATION MANAGEMENT SYSTEM FOR THE CALIFORNIA STATE WATER RESOURCES CONTROL BOARD (SWRCB) **c08**
T. C. Heald and G. H. Redmann *In its* Quart. Tech. Rev., Vol. 2, No. 4 Jan. 1973 p 53-61 (For availability see N73-23970 14-34)
CSCL 09B

A study was made to establish the requirements for an integrated state-wide information management system for water quality control and water quality rights for the State of California. The data sources and end requirements were analyzed for the data collected and used by the numerous agencies, both State and Federal as well as the nine Regional Boards under the jurisdiction of the State Board. The report details the data interfaces and outlines the system design. A program plan and statement of work for implementation of the project is included. Author

N73-23978* Jet Propulsion Lab., Calif. Inst. of Tech., Pasadena.
ON THE FEASIBILITY OF EFFICIENT MULTIAMPLITUDE COMMUNICATION **c07**
J. G. Smith *In its* Quart. Tech. Rev., Vol. 2, No. 4 Jan. 1973 p 62-71 refs (For availability see N73-23970 14-34)
CSCL 17B

Bandwidth constraints in earth-satellite communication systems force consideration of uncoded M-ary modulation to obtain increased data rates. M-ary phase shift keying (MPSK) at first glance seems most promising because of the high transmitter efficiency achieved through Class C operation. Multiple phase-and-amplitude modulation candidates such as quadrature amplitude shift keying (QASK) appear less promising because the transmitter must operate at lower efficiency (in linear or multimode operation). However, initial studies indicate that QASK offers significant raw dc-power savings over MPSK, despite the reduced transmitter efficiency. For example, at S-band both solid-state and traveling wave tube (TWT) QASK transmitters can provide a 3-db average dc-power savings over comparable 16-ary phase shift keying (PSK) for the same bit rate and error probability. The reason for this savings is that QASK requires

much less average signal-to-noise ratio than 16-ary PSK for the same error rate. Author

N73-23979* Jet Propulsion Lab., Calif. Inst. of Tech., Pasadena.
HELICOPTER VISUAL AID SYSTEM c02
R. L. Baisley *In its* Quart. Tech. Rev., Vol. 2, No. 4 Jan. 1973 p 72-86 ref (For availability see N73-23970 14-34) CSCL 01C

The results of an evaluation of police helicopter effectiveness revealed a need for improved visual capability. A method was developed that would enhance visual observation capability for both day and night usage and demonstrated the feasibility of the adopted approach. This approach made use of remote pointable optics, a display screen, a slaved covert searchlight, and a coupled camera. The approach proved feasible through field testing and by judgement against evaluation criteria. Author

N73-23980* Jet Propulsion Lab., Calif. Inst. of Tech., Pasadena.
THE MESA ARIZONA PUPIL TRACKING SYSTEM c05
D. L. Wright *In its* Quart. Tech. Rev., Vol. 2, No. 4 Jan. 1973 p 87-92 (For availability see N73-23970 14-34) CSCL 05E

A computer-based pupil tracking teacher monitoring system was designed for Mesa Public Schools, Mesa, Arizona. The established objectives of the system were to: (1) facilitate the economical collection and storage of student performance data necessary to objectively evaluate the relative effectiveness of teachers, instructional methods, materials, and applied concepts; and (2) identify, on a daily basis, those students requiring special attention in specific subject areas. The system encompasses computer hardware/software and integrated curricula progression/administration devices. It provides daily evaluation and monitoring of performance as students progress at class or individualized rates. In the process, it notifies the student and collects information necessary to validate or invalidate subject presentation devices, methods, materials, and measurement devices in terms of direct benefit to the students. The system utilizes a small-scale computer (e.g., IBM 1130) to assure low-cost replicability, and may be used for many subjects of instruction. Author

N73-23981# Human Engineering Labs., Aberdeen Proving Ground, Md.
MILITARY REQUIREMENTS FOR RESEARCH ON CONTINUOUS OPERATIONS
David C. Hodge Apr. 1972 207 p refs Conf. held at Lubbock, Tex., 28-29 Sep. 1971
(AD-744782; HEL-TM-12-72; Rept-73-00840) Avail: NTIS HC $12.50 CSCL 05/9

Reports on human performance under sustained work conditions are presented along with papers on interdisciplinary research in graduate programs. For individual titles, see N73-23982 through N73-23991.

N73-23982 Office of the Chief of Research and Development (Army), Washington, D.C.
REMARKS ON RESEARCH REQUIREMENTS FOR CONTINUOUS OPERATIONS
Jacob L. Barber *In* Human Eng. Labs. Mil. Requirements for Res. on Continuous Operations Apr. 1972 p 1-7 refs (For availability see N73-23981 14-34)

Factors that are important for determining the most useful directions for military research are discussed. The solution to the problem of seeing at night is presented as an example of using devices that are within or pushing the current state-of-the-art. The army field operations categories of combat, combat support, and combat service support are discussed. F.O.S.

N73-23983 Army Combat Developments Command, Fort Bliss, Tex.
TRENDS IN CURRENT RESEARCH
Louise B. Speck *In* Human Eng. Labs. Mil. Requirements for Res. on Continuous Operations Apr. 1972 p 8-19 (For availability see N73-23981 14-34)

On-going research which is relevant to the concept of continuous operations is discussed with emphasis on brain research. Methods to improve human performance in sustained operations are also discussed. F.O.S.

N73-23984 Texas Technological Univ., Lubbock.
UNIVERSITY INTERDISCIPLINARY RESEARCH PANEL
J. Knox Jones, Lawrence L. Graves, and John R. Bradford *In* Human Eng. Labs. Mil. Requirements for Res. on Continuous Operations Apr. 1972 p 20-38 (For availability see N73-23981 14-34)

The aspects of interdisciplinary research in graduate programs are discussed. Reducing the number of required courses, and prerequisites are suggested as a means of adapting programs to the individual requirements of the student. F.O.S.

N73-23985 Human Engineering Labs., Aberdeen Proving Ground, Md.
ENVIRONMENTAL QUALITY CONSIDERATIONS FOR CONTINUOUS OPERATIONS
David C. Hodge *In its* Mil. Requirements for Res. on Continuous Operations Apr. 1972 p 39-50 refs (For availability see N73-23981 14-34)

Hazards of exposure to noise, fumes, and vapors in the military environment are discussed in terms of hearing protection, and safe exposure limits for fumes and vapors. F.O.S.

N73-23986 Texas Technological Univ., Lubbock.
WORK-REST SCHEDULES UNDER PROLONGED VIBRATION WITH IMPLICATIONS TO MILITARY OPERATIONS c05
R. A. Dudek, M. M. Ayoub, M. A. El-Nawawi, and T. M. Khalil *In* Human Eng. Labs. Mil. Requirements for Res. on Continuous Operations Apr. 1972 p 51-69 refs (For availability see N73-23981 14-34)
(Contract DAAD05-69-C-0102)

Research of work schedules for single and multistation crews subjected to vibrational environments is discussed. Beneficial work schedules and work-rest ratios are provided. Author

N73-23987 Texas Technological Univ., Lubbock.
SELF DETERMINED WORK-REST CYCLES IN THE HEAT c05
J. D. Ramsey, C. G. Halcomb, and A. K. Mortagy *In* Human Eng. Labs. Mil. Requirements for Res. on Continuous Operations Apr. 1972 p 70-88 refs (For availability see N73-23981 14-34)
(Contract DAAD05-69-C-0102)

The selection of a rest schedule to optimize performance for monitoring type tasks is discussed along with the influence of working in a hot environment on performance and on selection of a work-rest schedule. Self-determined work-rest schedules were investigated for optimizing the subject's performance. It is concluded that using a self-determined work-rest procedure is useful to establish a desirable schedule for performing a task. However, after this is established, a specific schedule should be utilized to avoid those operators who would choose inappropriate schedules. F.O.S.

N73-23988 Louisville Univ., Ky. Performance Research Lab.
APPLICABILITY OF RESEARCH ON SUSTAINED PERFORMANCE, ENDURANCE, AND WORK-REST SCHEDULING TO THE DEVELOPMENT OF CONCEPTS AND DOCTRINE OF CONTINUOUS OPERATIONS c05
Ben B. Morgan, Jr. and Earl A. Alluisi *In* Human Eng. Labs. Mil. Requirements for Res. on Continuous Operations Apr. 1972 p 89-115 refs (For availability see N73-23981 14-34)

The effects of work-rest schedules, circadian rhythms, continuous work, and sleep loss on work behavior or sustained performance were studied. A description of this research, including a discussion of the synthetic-work methodology and the multiple-task performance battery that is the foundation of that methodology, is presented. Some of the more important findings of this research are also presented, and the applicability of these findings to the requirements for continuous operations is discussed. Author

N73-23989 Human Factors Research, Inc., Los Angeles, Calif.
SOME OBSERVATIONS FROM A LITERATURE REVIEW TO ANTICIPATE BIOLOGICAL PROBLEMS THAT MIGHT ARISE IN SUSTAINED AND CONTINUOUS OPERATIONS c05
James F. OHanlon *In* Human Eng. Labs. Mil. Requirements for Res. on Continuous Operations Apr. 1972 p 116-132

refs (For availability see N73-23981 14-34)
(Contract DAHC04-71-C-0015)

The biological effects of sleep deprivation, and the effects of prolonged physical work with respect to present concepts of sustained and continuous operations are discussed. It is concluded that under realistic field conditions, it is expected that the degradation in performance and physiological status will occur rapidly and recovery will be slow as a consequence of the combination and interaction of the effects of numerous stressors. F.O.S.

N73-23990 Texas Technological Univ., Lubbock.
PHYSIOLOGICAL RESPONSE TO PROLONGED MUSCULAR ACTIVITY **c05**
M. M. Ayoub, Ed Burkhardt, Gene Coleman, and Nancy Bethea *In* Human Eng. Labs. Mil. Requirements for Res. on Continuous Operations Apr. 1972 p 133-187 refs (For availability see N73-23981 14-34)
(Contract DAAD05-69-C-0102)

The ability of man to work for an extended period of time without fatigue, and the recovery patterns with alternating levels of load were studied to assess the oxygen consumption build-up as the activity progressed. Experiments conducted include: alternating physical loads, eight and sixteen hour experimentation twenty four hour experimentation, and physiological rhythms. Results of the measurements are discussed. F.O.S.

N73-23991 George Washington Univ., Washington, D.C.
THE CONFERENCE SUMMARY
Carl James Lange *In* Human Eng. Labs. Mil. Requirements for Res. on Continuous Operations Apr. 1973 p 188-194 (For availability see N73-23981 14-34)

The need for a precise definition of continuous operations, and research strategy are discussed. Suggestions for definite schedules of topics for future conferences are included. F.O.S.

N73-23992*# Jet Propulsion Lab., Calif. Inst. of Tech., Pasadena.
A PILOT DEMONSTRATION PROJECT OF TECHNOLOGY APPLICATION FROM THE AEROSPACE INDUSTRY TO CITY MANAGEMENT (FOUR CITIES PROGRAM) Annual Report, 1 Jul. 1971 - Oct. 1972
George F. Ervin and Llyod S. Blomeyer 13 Nov. 1972 51 p Sponsored in part by NSF
(Contract NAS7-100)
(NASA-CR-131918; PB-213836/0; JPL-650-159; AR-1) Avail: NTIS CSCL 05A

The Four Cities Program has completed the first year of the planned two-year program. At the beginning of the first year, a variety of program initiation activities were accomplished. Contracts were negotiated; science and technology advisors were interviewed, selected and assigned; general indoctrination and integration of the advisors into city affairs occurred; technical needs were identified and related projects pursued; pilot projects for the second year were identified; inter-city coordination on technical problems began to emerge; and the general soundness of the four cities program seems to have been established. Above all, the inter-personal relationships between the advisors and their interfaces in city government appear to be functioning smoothly. The establishment of such mutual respect, trusts, and confidences are believed essential to the success of the program. Author (GRA)

N73-23993# Naval Postgraduate School, Monterey, Calif.
ANALYSIS OF COMPUTING METHODS FOR THE TERRIER FIRE CONTROL SYSTEM M.S. Thesis
James Ray Williamson Dec. 1972 78 p refs
(AD-758499) Avail: NTIS CSCL 19/5

Future modifications in the TERRIER missile fire control system will be restricted by limitations in unallocated core and by problem solution time in the system's digital computer. The thesis is an analysis of methods by which reductions in core storage requirements and in problem solution time could be achieved. A determination of those functions requiring the most computer resources is made and alternative methods of computing the functions are analyzed. Comparisons of implementation of the functions by software in the fire control computer versus other devices are made, and the tradeoffs required by each method are presented. Author (GRA)

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NASA Thesaurus: Alphabetical Update (NASA SP–7040)

This publication, an updating of the Alphabetical Section of the NASA Thesaurus (Preliminary Edition) (NASA SP–7030), contains all subject terms that have been approved for use in cataloging and searching documents in the NASA scientific and technical information system. Each subject term carries scope notes, subject categories, and cross references as applicable. *Paperbound.* 624 pp. For sale by the National Technical Information Service, Springfield, Va. 22151, for $6.00.

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